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Vol. V. NEW YORK, MAY 23, 1885. No. 21.

Handsomely bound volumes of THE ELECTRICAL WORLD *for* 1884 *are now ready, and will be sent, charges prepaid, to any address on receipt of* $5.00.

WE understand that the Executive Committee of the National Electric Light Association will meet on Tuesday, June 9, at the Union Square Hotel, New York, on the call of Mr. Geo. S. Bowen, chairman.

TENNYSON'S latest—the quatrain purporting to be an epitaph on Gordon—suffered terribly at the hands of the telegraphers in their attempt to transmit it over the cable. The line "But somewhere dead in the far waste Soudan" was left out altogether—"didn't come," of course—while the three remaining lines were divided up into six. Rumor says the error occurred on this side—near Boston, to be precise—but we cannot believe that any of Boston's cultured citizens could commit such a sacrilege.

WE give to-day the first annual report of the Electric Railway Company of the United States (Edison-Field system). It will be seen that the company hopes to begin its promised work on the elevated roads of this city either during May or next month. The preparations are in a ryve forward state.

THE *Sun*, of this city, opposes the proposition to light the southern half of Central Park at night. The idea is to light it partly by gas and partly by electricity. The *Sun* claims that in the public interest the park should be closed at night, but in any case gas should not be used. It shows that gas is destructive to trees, which, wherever gas is used, die capriciously and mysteriously. There may be room for differences of opinion as to the advisability of lighting the park at night; but if it is to be lighted, there can be no doubt as to the vast superiority of the electric light over gas.

IT is already known that the English Government threaten to withdraw their bill for the introduction of six-penny telegrams, if the amendment is pushed to have the telegrams include, besides the ten-word body, the full address of the recipient and full name of sender. From a London dispatch dated May 18, it would appear that the adoption of the original measure is still regarded as likely. Half a million pounds has already been expended for new poles, wires, instruments, etc. Over 20,000 miles of additional wires have been laid, and 1,200 extra operators and over 1,000 new messengers will be engaged.

THE crocodile's tears which Mr. Pender, of the Anglo-American-French-Gould cable combination, sheds over the prospects of the new Mackay-Bennett cables seem rather out of place. Mr. Pender fears that the new cable is incurring a very serious loss, and that its promoters might have done better by investing their cash in other good paying American securities, particularly some investment which should not antagonize the old Anglo-Jay Gould monopoly. It will now be in order for Gen. Eckert to lament over the mad risks taken by the managers of the Baltimore & Ohio and the Postal Telegraph companies. Meanwhile the public is gratified to see the good work of competition go on.

A FEW days ago we commented upon the efficacy of the telegraph in detecting, tracing and arresting criminals, and mentioned the case of Maxwell, then slumbering in fancied security on the broad Pacific Ocean. Now the telegraph informs us of his arrest in far-off New Zealand—veritably the furthermost corner of the earth. Before the crime was even suspected Maxwell, under three different names, had left St. Louis and was far out on the Pacific Ocean. But, when the body of his victim was discovered, the wires quickly traced him from Boston to St. Louis and followed his flight to San Francisco. When leaving the ship in fancied security in New Zealand he walked into the officer's arms, he probably realized that the telegraph is a great institution.

ALTHOUGH the Commercial Cable Company may deserve the strictures passed upon its business methods and management by Mr. John Pender, it disregards the criticisms of that candid friend and goes on with its work of extension. In order to dispense with the irregular land service in the South of Ireland, it has now in course of manufacture a heavy cable containing two conductors, which will soon be laid from the company's station in Ireland to Bristol. It will thus have practically two land services to England from its cable terminus in Ireland. Another new feature is that by the construction of a special pole line between Havre and Paris, the company has established direct communication with the French Bourse, thus facilitating stock operations between New York and Paris.

THE American Institute of Electrical Engineers held its first annual session at the house of the American Society of Civil Engineers, New York City, on the 19th and 20th inst., too near the time of going to press for THE ELECTRICAL WORLD to make more than a brief reference to the meeting. That the sessions were interesting and profitable is demonstrated by the list of papers read, which is incorporated in our report. The extraordinary vitality of the young society is shown by the secretary's report, it having already 279 members and associates. This is a remarkable showing for one year of life, and indicates the need of such a society. The future of this latest scientific society is assured and its usefulness beyond question. Electrical societies in Europe are numerous and strong, and there is good reason to believe that here in America we can have one that will rank with the most prosperous and useful.

THE city of Savannah, Ga., has now been lighted by the Brush Company for three years, and it is evident that the arc lamps have given great satisfaction. At any rate, as little gas as possible is wanted for street lighting, and the mayor of the city has been authorized by the city council to enter into a contract for 90 arc lamps, an increase of 18 over the number heretofore in use. The offer of the company was to furnish 100 lamps at $25,000 per annum, the contract term being five years. The Savannah people, after three years' experience, estimate an arc lamp to be as efficient as 20 ordinary gas lamps. The award of this contract ought to be highly encouraging to electric light people everywhere. It shows what can be done in holding business and extending it when good service is rendered by the local company.

THE beauties of a governmental telegraph shine forth in all their effulgence in Egypt, where English fuss and feathers exercise a rigorous censorship over the wires. It is not long since the government absolutely stole—that is suppressed and appropriated to its own use—a correspondent's account of an important battle, filed for his paper. It was considered a tremendous "beat" on all the other London papers, but the government beat the enterprising correspondent by stealing his dispatch. Complaints now come thick and fast from Suakim of the arbitrary way in which the military censorship over the wires is carried out. The correspondents aver that they are not permitted to send important news at all. The bungling policy of the English Government in the Soudan is thus concealed from the people, though such a censorship over the telegraph seems like a feeble attempt to set back the hands of time.

SUITS have been brought by the President of the Erie Telegraph and Telephone Company and by other parties in interest, against Messrs. Ingham, Downs, Glidden, Bent and Coburn, the members of the once famous but now dissolved "Lowell Telephone Syndicate," on the ground of fraudulent misrepresentations as to the value and earning capacity of the Erie Company's franchises and property at the time the syndicate placed the stock upon the market. All the real estate, bank stocks, bonds and other property of the members of the syndicate above named has been attached, and the aggregate of damages claimed is stated at one hundred and thirty-five thousand dollars. This is the result of one of the most phenomenal investment excitements ever known in this country. Unlike the petroleum fever, which raged everywhere, the telephone stock fever was largely confined to Lowell, where it raged with great violence. Everybody who had money, or could get it in any way, was ready and willing to invest, all believing that a rise was inevitable and that then they could unload. But it was the old story. So long as everybody wanted to buy, there was a lack of stocks, and prices stiffened daily, but when everybody wanted to realize the price fell off wonderfully, leaving many investors, who had gone in on borrowed money, high and dry. The syndicate helped many of the unfortunate ones out by buying their stock back at the prices which they paid, but to very many the collapse in the market price brought very serious loss. The parties bringing the suit have retained General Butler as their chief counsel, and evidently intend to make a strong fight, but it is not believed that the charges of fraudulent misrepresentation can be sustained. The fact is that at the time in question the Lowell people would buy anything in the way of telephone stock, and at almost any price, without inquiring into its history or prospects. They bought to sell again, but unfortunately for some of them, they did not sell soon enough. Hence these tears.

EVEN among the regular readers of electrical journals and books there are many persons who welcome anything that discusses the elementary principles of the science in a clear, intelligent and helpful manner. Some of them are connected with one of the numerous electrical industries of the day, others take a general interest in the progress of knowledge and invention, and others again are like the expert musicians who never weary of going back, for practice, to the scales and exercises with which they began. The fact is, that of late years there has been an enormous increase in the number of those who are interested in the study of electricity, and that to-day the number is greater than it ever was before. Hence arises a demand for simple treatises on the subject We have ourselves from time to time endeavored to supply the want, and have met with no small measure of success, doing much, we hope and believe, to popularize the science and make its principles the property of all who sought for information on the subject. With a field to which the new-comers are so numerous, and in which the advances are so rapid and important, it is necessary, however, to renew or revise work of this nature from time to time, and we have therefore begun the publication of some admirable chapters on electricity by Mr. Philip Atkinson, A. M., Ph. D., who is well known as an electrical writer and investigator. New and original cuts have been made for the purpose of illustrating his text, and it has been sought to give the reader, no matter how crude or vague his ideas may have been before, a thorough grasp on leading principles. We think that in publishing the chapters at short intervals, many will be tempted to read and study who would shrink from the mental effort implied in taking up a dry book that is to be mastered as a whole, and that in the end the same good purpose will have been served. It will be observed, too, that where reference is made to apparatus, the material is cheap and easily procurable.

THE BELL TELEPHONE CONFERENCE.

Trouble has long been brewing between the American Bell Telephone Company and many of its licensees, who have come to feel that they are paying the parent company too large a slice of their gross receipts, and that their royalty payments constitute too heavy a fixed charge upon their business. It is universally admitted that a parent company owning and maintaining patents is justly entitled to a fair royalty for instruments used, and also to a reasonable proportion of the stock in its sub-companies, as an equivalent for the exclusive franchise granted; but what constitutes a "fair royalty" and a "reasonable proportion" is a matter not easy to determine. This much, however, is certain: When the royalty is so heavy that the sub-companies find no profit left for themselves, and when the stock concession exceeds one-half of the whole capital, circumstances would seem to indicate that there was no further question. Now, it is a fact that many of the Bell Company's licensees have given up one-half of an enormously inflated capital for the privilege of doing a business, the royalty charges upon which are so heavy that no profit is left after paying wear and tear and running expenses. Hence it is that the stocks of so many sub-companies—the vast majority of them, for that matter—are utterly unsalable, save at figures varying from one-fifth to one-half their nominal value, and that even at these reduced figures there is but little disposition to purchase. The American Bell Company has an enormous holding of such stock, but the great bulk of it, so far as earning capacity is concerned, might as well be waste paper. Under these circumstances, the American Bell Telephone Company has issued an invitation to its chief licensees to send one delegate each to a conference to be held in Boston, June 8, and to continue until June 13, during which period they are to be the parent company's guests, and to partake of its hospitality, which is always generous. At this conference the whole matter of the relations between the parent and its subsidiary companies is to be considered and discussed, and the latter are to have an opportunity to present and discuss their grievances, if they have any.

Complaint is brought that, in dealing with its sub-companies, the American Bell Telephone Company has made fish of some and flesh of others. Of course, it had the legal right to make the best terms it could with each, but it is contended that there is a recognized equitable principle that all customers who are practically purchasing the same thing ought to be put upon about the same footing. This point, therefore, of demanding varying proportions of the capital stock, all the way from thirty-five per cent. up to fifty per cent., in payment for a perpetual franchise, is likely to come up, and to receive the very serious attention of both host and guests.

Another point, of the utmost weight to licensees, is the adoption of some sort of sliding scale for the determination of royalties, instead of the fixed charge of $14 per station now demanded in all cases. It is clear that when a company gets from its subscribers only thirty dollars a year for the use of the telephone, it cannot afford to pay as much annual rental for the instrument as a company getting one hundred and fifty dollars from each subscriber; and yet the present contracts of the Bell Company recognize no such difference, and it is not too much to say that, in some companies controlled by the Bell Company small exchanges have been established which could not by any possibility be made remunerative, and whose only function has seemed to be to increase the output of Bell telephones, and to swell the company's royalty receipts, to the serious detriment of the private holders of the stock of such licensee companies. The remedy suggested is a sliding scale of royalty charges, and this will no doubt be stoutly demanded. The relief will be slight, but it will be something.

Something has got to be done to put the telephone business on its feet again, and restore confidence in it as a paying business, and the Bell Telephone Company has, it would seem, wisely recognized the propriety of taking the initiative. If it will put royalties on an equitable basis and *waive all dividends* on franchise stock for five years, it will have larger cash receipts during that period than if its present policy is pursued, and at the end of that time its franchise stock will at least be worth something. We venture to suggest that the Bell Company make its decision before the conference meets, that it announce a liberal and generous policy at the first session, and that the rest of the time be devoted to recreation. The suburbs of Boston are charming in the early days of June, and her harbor is a joy forever.

REVIEWS OF NEW BOOKS.

DISTRIBUZIONE DELLA ENERGIA ELETTRICA A DOMICILIO AD ALTA TENSIONE ED A CORRIENTE CONTINUA. By P. Meardi. Milan. Ulrico Hoepli. 1885.

This is a short treatise on the general distribution of electricity at high tension, in which the principles involved are discussed and applied to several ideal cases, as well as to some that have been proposed.

ELETTRICITA E LE SUE APPLICAZIONI ALL'ESPOSIZIONE DI TORINO DEL 1884. By P. Meardi, Engineer. Published by *Il Giorno*. Milan. 1885.

This is a popular treatise on apparatus exhibited at the Turin Electrical Exhibition of 1884. It treats of the chief exhibits in each department of applied electricity, and gives a short sketch of the principles underlying their actions. The book of 253 pages is neatly printed, and contains seventy illustrations explanatory of the text.

A Valve Telephone Transmitter.

This transmitter, which is the joint invention of Prof. Sylvanus P. Thompson and Mr. P. Jolin, is of that class in which the air waves act directly upon the current regulator, without the employment of any tympanum or diaphragm. In the apparatus the sound waves formed by the voice are directed by means of a mouthpiece, and caused to pass upward through an orifice and impinge upon a valve. This valve rests freely over or upon the orifice, and its weight is supported by a valve-seat. The action of the sound waves upon the valve produces variations in an electrical current in a manner which is described in a recent number of the *Electrical Review*, of London, and will be understood from the following figures:

Figs. 1 and 2 illustrate a simple form of the valve telephone. *a* is the valve, which consists of a ball (preferably hollow) of some conducting material, supported upon the valve-seat *b*, which is a ring also of some conducting material, over the orifice of the tubular cavity *d*, in the block *B*, the sound waves being directed upward through the tube *d*. If the weight of the valve be insufficient to secure the requisite contact between valve and seat, the valve may be furnished with a stalk or tail-piece *c*, and a small weight at the end thereof. A light and flexible wire *c* is connected to the valve, so that the valve forms one electrode; the seat forming the other electrode. The sound waves will tend to lift the valve from its seat and let it down again, thereby varying the electric current, as in an ordinary microphone.

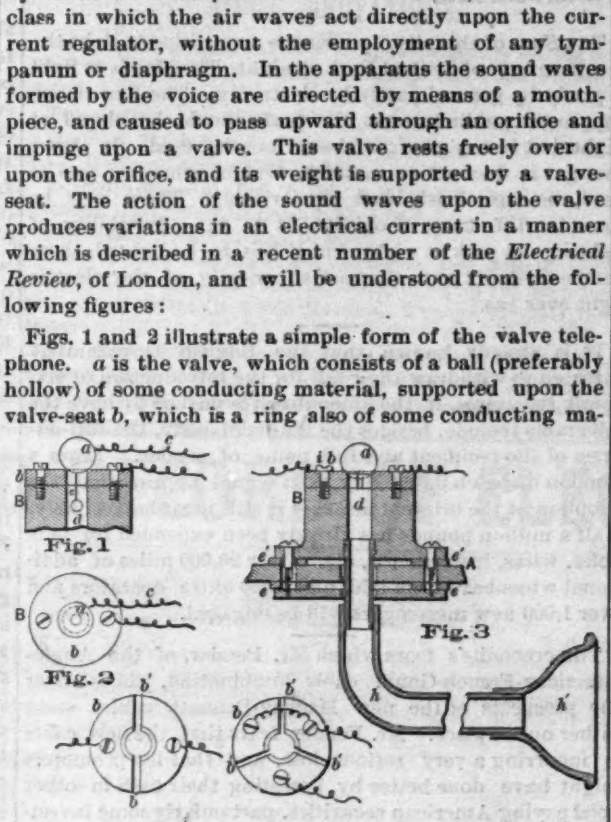


FIG. 4. FIG. 5.

THOMPSON'S VALVE TELEPHONE TRANSMITTER.

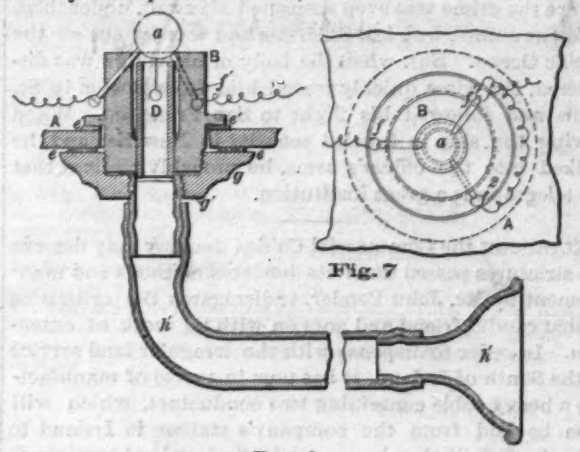


FIG. 6.

The spherical form of the valve shown possesses the advantages of being self-adjusting upon its seat and requiring no guidance.

As above described, the valve forms (or is part of) one electrode, and the seat forms the other electrode; the inventors prefer, however, to divide the seat into two or more parts or segments insulated from one another, as shown by Figs. 3, 4 and 5. In these cases, instead of using the valve as an electrode, they use one part or parts of the seat as one electrode, and the other part or parts of the seat as the other electrode; the valve in this case completing the circuit between the two electrodes. Fig. 3 also illustrates a convenient mode of fitting up the valve telephone.

It is well-known that when two rigid bodies are in contact, three points of contact determine their approximation one to another, whilst if it be attempted to produce a contact in four points an element of instability is introduced. For instance, a three-legged table always stands firm, even on an unlevel floor, whilst a rigid four-legged table will not stand firm, if the floor be level, unless the extremities of the legs are all in one plane, or on an unlevel floor unless the fourth leg be of such length as to reach the ground at the point where it should stand. Applying this principle to the valve telephones, the inventors find it to be very advantageous to seat the valve upon three pins of suitable conducting material, as shown in elevation by Fig. 6, and in plan by Fig. 7. By this means, the element of uncertainty in the action of the telephone due to the variation of the contact points of valve and seat, which is introduced if the surfaces are not fitted with mathematical accuracy, is eliminated. The pins should project above the orifice of the tube, so that the valve may be slightly raised above such orifice, leaving a narrow space between the valve and the edges of the orifice about the width of the thickness of a sheet of paper. This form of valve-seat may be applied with advantage to valves of other than a spherical shape. The pins may be adjustable, if desired, and may be made of metal tipped with gold, platinum, iridium, or other infusible metal or conducting material.

The conducting material used for the contact pieces may be such as is available for similar purposes in ordinary microphones or telephone transmitters; as, for example, any non-metallic substance, such as coke, which is a sufficiently good conductor, and which is capable of being made up into the desired form of valve. The inventors, however, state that a metal or metalloid or alloy answers the purpose as well as, and, in some cases, better than any non-metallic body; and, in particular, they have found that phosphor bronze, silicium bronze, selenium bronze, tellurium bronze, and sulphur bronze give good results.

It will be observed that the inventors arrange the valve relatively to the direction of motion of the sound waves, so that the increment of pressure due to the sound waves tends to lift or remove the valve from its seat, although the lifting of the valve should only take place to an infinitesimal extent. With this arrangement, the valve being free to move, as a whole, away from its seat, the motion or tendency of motion of the valve is simply one of translation, without deformation or change of shape, whence result the advantages in the utilization of the energy of the sound waves hereinbefore pointed out. The seat should be of such a form and so placed that it may not to any appreciable extent enter into vibration under the influence of the sound waves, so that the whole available energy of the sound waves may be as far as possible concentrated upon the valve alone.

For practical purposes the inventors find that the form of the instrument shown by Figs. 6 and 7 gives the best results in practice. In this instrument, the valve and valve-seat are carried by a cylindrical block *B* of wood. The block *B* passes, without touching, through a circular aperture formed in the bottom of the box or case *A*. The block *B* is supported and maintained in its position by two annular pieces or rings *e* and e^1 of India rubber or other equivalent dampening material, which encircle the said block and prevent vibrations of the box or case from affecting the working parts. *D* is a tube of brass or other suitable material, which is situated within a cylindrical cavity extending axially through the block *B*. The tube *D* fits closely the lower part of the said cavity, but there is an annular air space between the tube *D* and the upper portion of the inner surface of the block *B*. The tube *D* is of such length that its upper end is somewhat below the upper end of the block *B* which encircles it.

The valve *a* is seated upon three pins *f*, f^1, f^2, inserted in the upper portion of the block *B*. These pins should touch the sphere or ball *a* at three points, which preferably are equidistant, in a horizontal plane cutting the said sphere at a point below its centre. These pins are preferably tipped with gold, platinum, iridium, or other non-fusible metal or conducting material. The pins f^1, f^2, are connected together to form one electrode, and the third pin forms the other electrode.

Upon the lower end of the block is screwed or otherwise secured an annular cap or rose *g*, provided with a central opening g^1, into which is inserted the end of a speaking tube *h*, provided with a suitable mouth-piece h^1. The tube *h* may be either rigid or flexible.

A Diffusion Photometer.

M. A. Crova's photometer is based upon the principle that when a translucent screen is placed in a uniformly illuminated field, in a direction normal to the incident rays, each point of the screen may be regarded as a luminous source, and transmits light, the intensity of which depends upon the nature of the translucent material, in accordance with a law which also varies with the material; but in every case the rays diffused in a direction closely approaching the normal are equal in intensity. If there is placed behind the diffuser an opaque screen with an opening the size of which can be varied at will, the intensity of the light normally emitted by this opening is proportional to the intensity of the luminous field on which the diffuser is placed, to a coefficient which depends on the nature of the translucent substance, and to the area of the opening, and varies inversely with the square of the distance. M. Crova employs a Foucault photometer, one-half of the screen being illuminated by a standard light of one carcel lamp placed at the end of a blackened tube one metre in length, while the other half is illuminated by the light to be examined. The latter passes down a tube which is movable on a graduated circle fixed at right angles to the axis of the first tube. At the further end of this tube there is a rectangular opening, the breadth of which remains constant, while the length can be varied by means of a micrometer screw. This opening is placed against the diffuser, and the size of the opening is altered until the two halves of the screen of the photometer are equally illuminated. For intensities up to 400 carcels the diffuser is made of ground glass, while for higher intensities opal glass is used.

The Factory of the Bell Telephone Manufacturing Company of Antwerp.

When the telephone exchange had become an established fact in this country, other nations were not slow to avail themselves of the facilities offered by it, so that the International Bell Telephone Company of Boston, in order to carry on its business to greater advantage, found it necessary to establish a branch office at Antwerp, from which place its operations extended over the whole continent of Europe.

For this work the parent company at first imported into Antwerp not only a large quantity of materials of construction for the telephone districts, but, in addition, all the telephonic apparatus itself came from the best factories in this country. The hand telephones and the Blake transmitters came directly from the American Bell Telephone Company, of Boston, and the magneto-calls were made by Mr. Gilliland, of Indianapolis. The cost of transportation and the import duties evidently increased the price of the apparatus, and the foreign company sought naturally to avoid this by operating, in Europe, a factory modeled on the American plan, for the manufacture of the articles which it needed. For this purpose a company was formed, called the Bell Telephone Manufacturing Company. After some hesitation, the city of Antwerp was settled upon as the place for establishing the factory, which was built under the personal supervision of Mr. Gilliland, and equipped with machines and appliances imported from the United States.

The new factory, however, had hardly been completed when it was destroyed by fire, and everything had to be done over again. In the mean time the management had been transferred to Mr. Welles, who had for a long time been connected with the Western Electric Manufacturing Company, of New York, and under his effective management a new factory was soon equipped. Mr. Welles is now in this country for a few weeks.

Our illustration, for which we are indebted to *La Lumière Electrique*, gives an excellent view of one of the workshops.

The principal work still consists in the manufacture of telephonic apparatus, and under the able direction of Mr. Welles the new enterprise has been put into business connection with all the countries of Europe, enjoying to-day an excellent and well-merited reputation.

The factory is lighted by electricity, 12 arc lamps being used in the workshops and a number of incandescent lamps in the office and small work-rooms. The company furnishes apparatus to a large number of telephone districts in England, and its business has grown so large there that it has opened a branch office in London.

Electrical Studies at Cornell University.

BY PROF. W. A. ANTHONY.

The course in electrical engineering in Cornell University has now been established for two years, and is already well patronized. It requires four years of study for its completion, the object being to turn out, not electricians or electrical engineers merely, but educated men. To enter it students must have a knowledge of the common English branches and a part of algebra and geometry. In the university they pursue the mathematics through calculus, study the French or the German language, give some time to the study of English, devote several terms to the theory and practice of machine drawing, pursue for final terms the study of mechanics as applied to engineering, besides the work in general physics and electricity, which occupies a considerable portion of the time for three years.

As to equipment, the physical department of the university where the study of electricity is pursued is supplied with very complete arrangements for the experimental study of electrical science and its applications. The best instruments for electrical measurements are at hand, and students have practice in measuring resistances of conductors, of batteries and of instruments. They learn to test the accuracy of the instruments they employ. They measure electromotive forces by the quadrant and absolute electrometer as well as by various other means. There are four dynamo machines under charge of the department, besides several lecture room models and electric motors. Students make complete measurements and tests of these, and make constant use of them for various experiments. For instance, one student has been experimenting since last winter upon the effect of the various kinds of covering upon the rise of temperature of wires heated by electric currents; another has been comparing the different photometric methods as applied to the measurement of the illuminating power of arc lamps; another has been comparing the deposits of copper in voltameters having different sizes of plates, in neutral and acid solutions, in solutions of different degrees of concentration. Currents of various strengths from 1 to 10 ampères were employed. Silver voltameters were also compared with copper.

There is just now being completed a "magnetic observatory" for furnishing facilities for magnetic experiments and electrical experiments that depend upon the uniformity of the magnetic field around the instrument.

Iron has been rigidly excluded from the construction of the building. Here will be mounted the instruments for determining the elements of the earth's magnetic field, but the principal instrument is an enormous tangent galvanometer on the Helmholtz plan, capable of measuring currents from $\frac{1}{100}$ ampère to 200 ampères. The conductors for heavy currents are three-quarter inch copper rods. The deflections of the needle are read on a graduated circle fifty inches in diameter, and a suspended coil one metre in diameter, of 100 turns of wire, furnishes the means of determining the horizontal intensity of the earth's field at the exact place of the instrument at any moment, by observations requiring but a few minutes.

This observatory is placed so far from any of the other buildings as to be free from any magnetic disturbance from moving masses of iron. It is connected with the laboratory by several wires, among which is a pair of 0000 copper, for conveying the heavy currents. In connection with this equipment and as accessory to the large tangent galvanometer, is a set of German silver resistances consisting of 36,000 feet of No. 16 wire in 60 sections of 600 feet each, connected to switches that permit of combinations in series, or multiple arc, or "multiple series," in all desirable ways. They give a variety of resistances from three-fifths ohm to 1800 ohms.

The large tangent galvanometer has been constructed at the university and it is proposed to construct next year a standard potential instrument to permit of the accurate measurement of all potentials.

All these instruments will be used by students as they have occasion. During this year several small dynamos and motors have been tested here, the students taking part in the work, and it is proposed in the future to continu this work of testing upon larger machines as opportunity offers.

WORKSHOP OF THE BELL TELEPHONE MANUFACTURING COMPANY AT ANTWERP.

Telegraphing and Telephoning Simultaneously Over the Same Wire.

The concessions which have recently been made by the French government to the promoters of the Van Rysselberghe system of simultaneous telegraphy and telephony over the same wire have excited considerable interest in this enterprise. Our readers will remember that our issues of Feb. 9 and 16 of last year contained an exhaustive description of the methods employed, which were at that time applied to the working of a number of Belgian lines. Since then the system has been improved and enlarged to such an extent as to embrace nearly all the Belgian lines, and its introduction into Spain and France is now under way.

M. Van Rysselberghe has accomplished two objects, viz.: First, the suppression of the disturbing effects of induction of telegraph on telephone lines; and, secondly, the utilization of the wires of these lines for both telegraphic and telephonic transmission at the same time. He obtains the double result by the *graduation* of the telegraphic curren ts

and by the separation of the telegraphic and telephonic currents in the stations connected.

As explained at that time, it is well known that the most marked, and consequently the most troublesome, induced currents caused by telegraphic action are those which correspond to the closing and opening of the inducing circuit, and that their intensity is directly proportioned to that of the currents which have given rise to them at these two periods of the formation of a telegraphic signal. Therefore, to *graduate* the emission and the interruption of the primary current in such a manner that it may increase regularly from zero to its maximum and diminish regularly from its maximum to zero, is to reduce the strength of the induced currents and to *graduate* them; that is to say, in fine, to make the vibrating diaphragm of the receiving telephone merely bend without giving rise to any sound.

This graduating of the currents is obtained by the use of condensers and electro-magnets. The diagram, Fig. 1, shows the manner in which a telephone and a telegraph office are equipped for simultaneous transmission. Be-

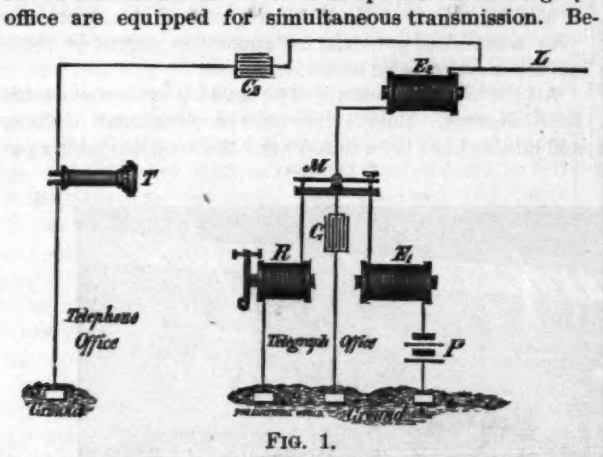


FIG. 1.

tween the key *M* and the line *L* and the key and battery are interposed respectively two graduating electro-magnets E_2 and E_1, each having a resistance of about 500 ohms. Between the relay *R* and electro-magnet E_1 is placed the *graduating* condenser C_1, which is made to form a derivation to the ground between the two electro-magnets E_1, E_2. Finally, there is interposed between the two offices the "separating condenser" C_2, which, as its name indicates, keeps the two classes of signals distinct. The graduating condenser C_1 has a capacity of 0.5 microfarad, and, if need be, of 0.1 microfarad only; and the separating condenser C_2 has a capacity of 2 microfarads. In this way the independence of the two modes of communication is realized.

Unlike American lines, the large majority of telephone lines within cities in Europe constitute complete metallic circuits, and in order to apply his system to this double circuit M. Van Rysselberghe has devised the installation shown in the diagram, Fig. 2, by which means the *trunk lines* can be utilized. Our former issues, above referred to, contain a full explanation of this diagram, but we may repeat that the inventor uses "repeating" induction coils, and connects with the ground the middle portion of that of the two wires of the induction coil which constitutes the telephonic "bridge" between the two lines L_1 L_2 (Fig. 2.) This wire of the induction coil is represented by the

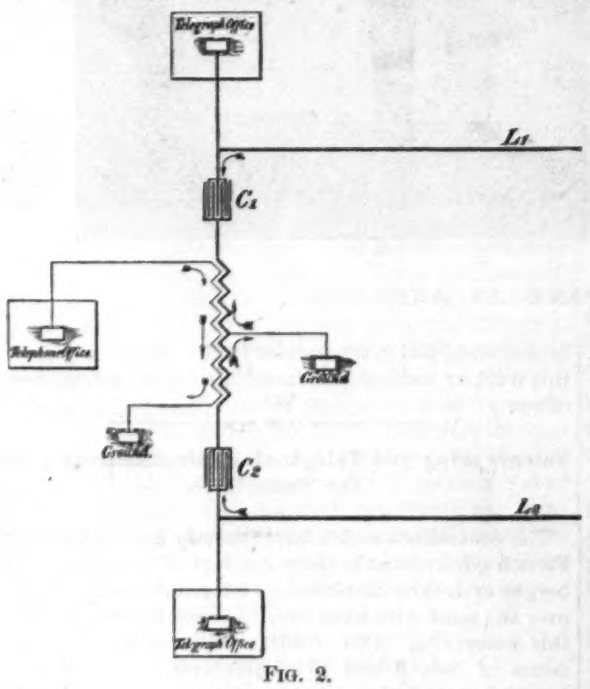


FIG. 2.

heavy zig-zag line. The other wire which is in the local telephonic circle itself is shown by the lighter zig-zag line running parallel with the first. Each portion of the heavy line constitutes a distinct induction coil, which has nothing in common with the other except the ground connection, and the axes or iron cores of the two coils are placed at right angles to each other.

In order to perfect and improve his system, however, M. Van Rysselberghe turned his attention to the microphone, and he has succeeded in considerably increasing the power of this part of the apparatus in a simple and effective manner and described in "Téléphonie à Grande Distance," by Ch. Mourlon, copies of which have been forwarded us by the author. It is well known that in the carbon transmitters and microphones the electric reproduction of the human voice is due to the variations of resistance which are created in the carbon contacts under the influence of the vibrations which agitate the diaphragm of the microphone. The researches and experiments of M. Van Rysselberghe confirm the hypothesis that the variations of the resistance of the contacts are of much more relative value, and the variations of the current which result from them are much more considerable when the total resistance of the circuit is more feeble.

As a result of this discovery, M. Van Rysselberghe recommends for the production of the current an element or elements of extremely low internal resistance. In that case, secondary cells or accumulators and thermo-electric piles can be employed with advantage. It is not, however, sufficient to diminish the internal resistance of the battery; the resistance of the microphone must also undergo diminution, and in order to effect that purpose he has had recourse to a number of contacts arranged in multiple arc. This arrangement is shown in Fig. 3.

P may be either a Planté or a Faure accumulator, or a Leclanché or Warnon cell of large plate surface, and therefore of low internal resistance. *A B C D* is a small deal planchette or table, of the same dimensions as that adopted for the Ader microphone. Upon this are disposed, parallel to each other, eight small carbon pencils, connected in multiple arc, and constituting the contacts of the microphone. The total resistance of this instrument does not exceed 2 ohms, while that of the greater number of microphones in ordinary use is about 16 ohms. *E* is an induction coil having a primary circuit of small resistance. M. Van Rysselberghe has also minimized the resistance of the secondary circuit, for the reason that long-distance transmission necessitates the use of currents of *quantity*, and not of *tension*. In Fig. 4 the ordinary apparatus designed for service in a telephone office, for long-distance working, is shown. This apparatus consists of a box of walnut wood containing a complete inductor,

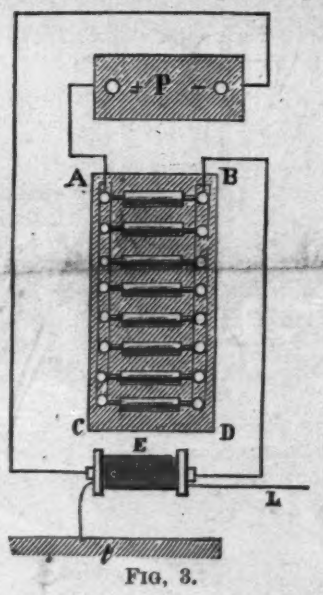


FIG. 3.

which, by means of a small crank placed at the side of the box, actuates the two bells in connection with the two offices. These bells are entirely independent of the transmitting apparatus.

The cover of the before-mentioned box also carries the carbons of the microphone. The small table which supports them is, as we have said, somewhat similar to that of the Ader microphone, but it differs from the latter in that instead of being fixed it is merely packed in a metallic frame. The receiver is a Bell telephone, sheathed in ebonite, the resistance of the coil of which is less than 100 ohms. This receiver rests upon two hooks, one of which is fixed, while the other, which is automatic, acts as a commutator. The installation of the apparatus is very easily effected, and, once placed in position, it does not require to be regulated, nor is it liable to get out of order. An ebonite cylinder is arranged upon the table of the microphone in order to collect the sound vibrations, and direct them perpendicularly upon the diaphragm. This modification is a very simple one, and has given excellent results in regard to distinct articulation.

Fig. 5 is a second model, in which the micro-telephone is mounted upon a desk, so that the messages may be written down as they are received. A paper clip in the form of a hand serves to retain the paper in position. The magneto call is placed beneath the desk, and is put in action by a small crank wheel, which, together with the bell, is of the same description as in Fig. 4. There are six terminals in all, *L* communicating with the line, *T* with the earth, *S S* with the two bells, while *P P* are connected to the respective poles of a Leclanché battery of the large pattern, placed in a box underneath the apparatus, and resting on the ground.

The last experiments of M. Van Rysselberghe, conducted in the presence of the officials of the Belgian state, sufficiently proved that in order to arrive at perfection it was necessary to make use of very sensitive microphones. The objection has been urged that the expense of replacing the instruments ordinarily used by those of the new system would be considerable, and in order to meet this objection, M. Van Rysselberghe has specially designed some effective and economical improvements to the existing apparatus. The later experiments which have been conducted, *i. e.*, between Ostend and Brussels, 77.5 miles; Antwerp and Brussels, 34.1 miles; Paris and Brussels, 207.7 miles; Oporto and Lisbon, 193.6 miles; Rouen and Le Havre, 57 miles; and, finally, in the Argentine Republic, between Buenos Ayres and Rosario, a distance of 217 miles, have given every satisfaction. The microphones used in these experiments were the same which have been installed in the Théâtre de la Monnaie in Brussels, and which enabled Her Majesty the Queen of the Belgians to hear at her Châlet Royal at Ostend, and later at the Laeken Palace, the music and songs of the opera in Brussels. On the latter

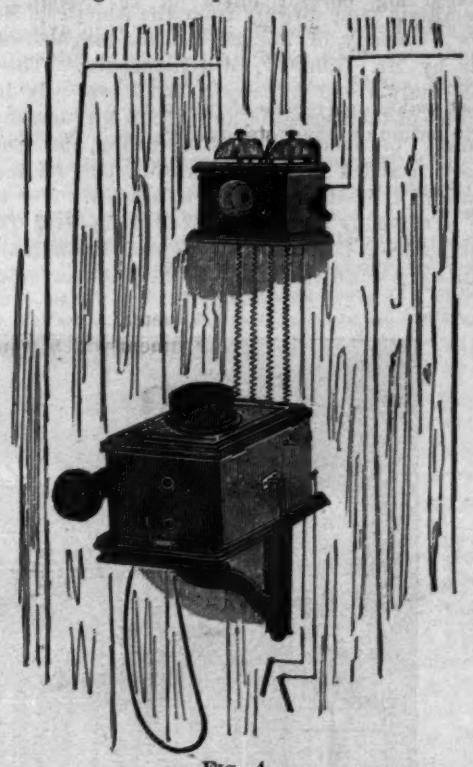


FIG. 4.

occasion the Bell Telephone Company in that city lent its wires from the theatre to one of the offices of the state, which was in actual telegraphic communication with the palace of Laeken, situated some miles from the town; and, although the music was transmitted distinctly and satisfactorily, no interruption whatever resulted to the telegraphic service then being carried on. As a result of that experiment, Her Majesty has ordered a permanent installation to be put down between the palace and the opera-house in Brussels. The number of microphones necessary for such an installation is fourteen. These are all mounted in multiple arc, and connected to a Faure accumulator of 50 kilos. placed beneath the stage. The accumulator is fed continually by a Bunsen battery, which also serves to actuate the regulators required during the representations in the electric lighting of the stage.

Charging Secondary Batteries.

To the Editor of The Electrical World:

I wish to make a storage battery, to be charged by four

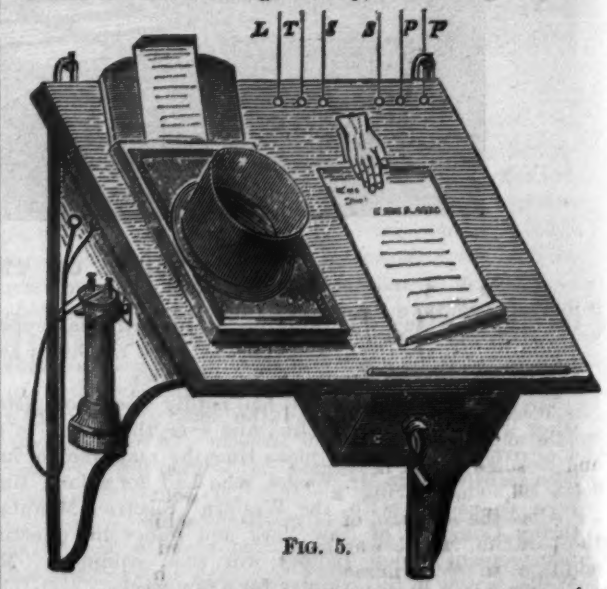


FIG. 5.

cells of Leclanché battery. What I want to know is: 1. What weight or what size should the lead plates be? 2. Are the lead plates of a storage battery ordinary sheet lead? 3. What good, simple works can I get on storage batteries? By inserting the above in your valuable paper you will greatly oblige a subscriber. L. M.

MILWAUKEE, Wis.

ANSWER.—1. About as large in area, including both plates, as that of the inclosing porous cell of the type of primary cell mentioned. 2. Yes. 3. There is very little literature in book form on the subject. Gladstone & Tribe's "Chemistry of the Secondary Batteries of Planté and Faure" can be recommended. It is obtainable from this office, price $1. The Leclanché is not used for this purpose.

Photometrical Measurement of the Incandescent Lamp.

There is perhaps no branch of the applied sciences which has called into play more methods of physical measurement than that of electricity in its various departments. The electric light especially requires for the determination of its economic value an extended system of physical measurement which in delicacy of treatment and refinement of methods is not excelled by any other province of the electrician's art. We have to deal here not only with the measurement of power consumed in the generation of the electric current and the value and character of the current generated, but we are required also to know the results which the applied power and resulting current effect in the production of light. We have, therefore, first, a series of dynamometrical measurements; secondly, electrical measurements; and thirdly, photometrical measurements. Of these three, the last undoubtedly presents the most difficulties in the determination of exact standard values. As regards the first, a good transmitting dynamometer combined with the steam-engine indicator will give results which are easily obtained, and whose limit of error will be very small. So, too, with good electrical instruments, well calibrated, the indications obtained may be relied upon with implicit faith.

When we come to the photometer, however, we are brought face to face with an instrument which requires to be applied in a most critical manner, in order that it may give results of any value whatever. As in other physical measurements, light requires a standard of comparison, and this most essential element alone was, until quite recently, a thing of very uncertain character. In this country and in England the standard spermaceti candle supplied the place of a standard. In France, and to some extent in Germany, the carcel lamp, burning colza oil, and having a value of about 9.8 candles, served as the standard of comparison; while in Germany the paraffine candle was largely employed as such. In addition to this, numerous others, such as gas standards, have been employed, so that uniformity may be said to have been out of the question. This state of affairs, experienced almost from the beginning of electric lighting on a commercial scale, attracted the attention of electricians, and several electrical congresses have sought in vain to establish some acceptable standard. But it was not until the past year that any definite action was taken in the matter and a standard adopted. This standard, it will be remembered, is the light emitted at right angles from a surface of molten platinum one square centimetre in area. Here we have a standard, it is true, but one against which several objections have been raised, one of the most important being that it is difficult of practical application. While this is true, it does not carry the weight which some would make it appear to. A standard of fixed character once determined upon, derived or secondary standards can be easily devised which can be verified by the original as often as necessary.

Besides the element of uncertainty which has existed in regard to the standard, there are a number of other troubles which appear on comparing lights of different luminous characters. Thus in comparing the brilliant arc light with the flame of a carcel lamp, for instance, an error is introduced on account of the different colors of the lights, white and yellow. It is the eye which in this case is variably affected, so that in such cases special allowances must be made in order to get accurate results. In most optical photometrical measurements, the eye is constituted judge of a particular condition of illumination, and it requires a special training and to a certain extent always introduces a source of error, which can only be reduced by taking a large number of measurements and averaging the results.

This uncertainty of the eye in judging has given rise to other methods of comparison, among these being chemical photometers which depend for their action upon the effects of light on certain substances. Still another is the selenium photometer, the operation of which depends on the change in resistance effected upon selenium by the action of light.

Of the numerous photometers which have been proposed and constructed, that of Bunsen may be said to have come into the most extended use. The action of this instrument is based primarily on the well-known law that the intensity of illumination of a surface varies as the square of the distance from the source of light. It further depends upon the fact that a grease or oil spot upon a sheet of paper disappears when both sides are illuminated to the same degree.

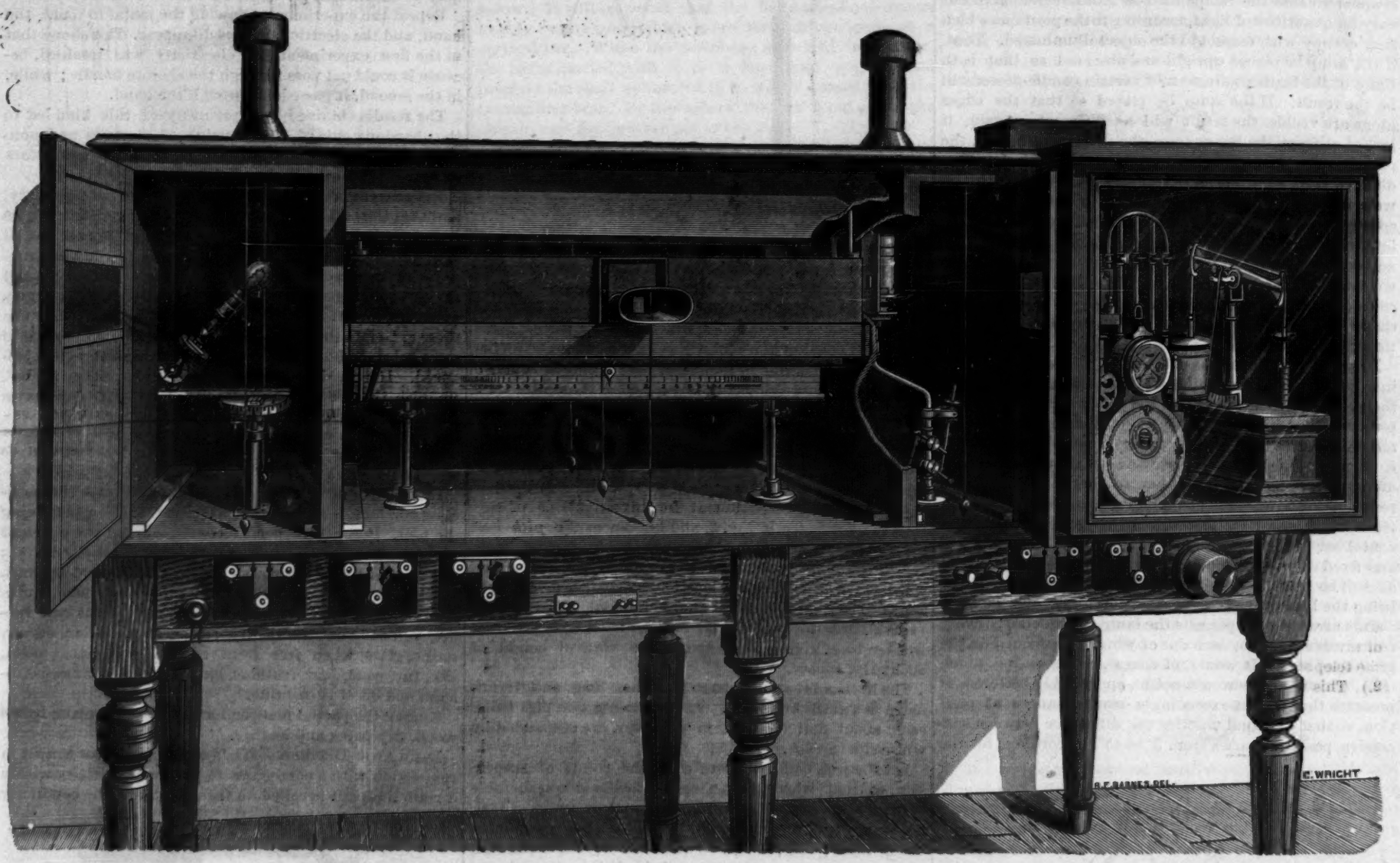
Such a photometer is the one shown in our engraving, which represents the instrument employed by Mr. Weston in his laboratory at Newark, N. J., for determining the illumination of his incandescent lamps.

In the centre of the apparatus, which was exhibited at the Philadelphia Electrical Exhibition, will be seen a funnel to which the eyes are applied, and which shuts out any extraneous light that might be diffused in the dark room where all such measurements are made. This funnel is attached to a small carriage which can be slid along the scale, and upon which is mounted a sheet of paper having at its centre a grease spot in the form of a star. Finally, two mirrors are placed respectively at angles of 45° on each side of the paper, so that by looking into the funnel an image of either side of the oiled spot is reflected directly into the funnel and to the eye of the observer.

Directly below the gallery in which the carriage slides is the scale, which is so graduated that the ratio of the candle-powers is read off directly. The centre of the scale is marked by a plumb line. So also the carriage is provided with two plumb lines, one in the front and the other in the rear. These travel with the former, and by reading the scale when the two lines coincide, all errors of parallax are avoided. In using the apparatus, the carriage is slid to the right or left, as the case may be, until the spot disappears, *i. e.*, until the star has the same white hue as the surrounding portion.

We now come to the source of illumination which acts as the standard of comparison, and which is placed at the right end of the gallery in which the carriage slides. The standard employed in this case is what is known as the Methven burner, and comes under the class of gas standards mentioned above. In place of it the standard candle may be employed, but the inconvenience attending its use, especially where a protracted series of experiments is undertaken, as in incandescent lamp determinations, has led to its almost total abandonment for this purpose. Among these reasons we may mention that constant corrections must be allowed on account of the varying rate of consumption of the candle. Again, the various conditions of the wick have a very marked effect upon the resultant light; so that for a large number of determinations the labor of calculation is very great, while the keeping in order of the wick is a constant source of anxiety and uncertainty in the results. For these and other causes a standard of a more permanent nature is desirable, and the Methven burner more nearly fulfills this requisite of permanency, provided certain precautions are taken.

This admirable burner is based upon the observed fact that the *quantity of light* which would pass through a vertical slot ¼-inch wide and 1 inch long, in an opaque screen, at a definite height from the base of an argand flame three inches long, or very nearly so, *was equal for all qualities of gas*, and certainly so for qualities of gas between 15 and 35 candle-power. The burner employed is the London argand No. 1, and the screen is placed very near to and at a fixed distance from the burner.



PHOTOMETER FOR MEASURING THE INTENSITY OF INCANDESCENT LAMPS.

It is evident that this standard of comparison is one of remarkable constancy, and that it is for this reason its use is extending daily. Our illustration shows the burner, which is of the argand type, and has rigidly fixed to it a brass screen with an oblong slot. This exposes a part of the flame, the illuminating power of which in the present instance is two candles. With accurate construction it is evident that the Methven burner is practically independent of the quality of the gas furnished by various companies, requiring only occasional verification for the sake of precaution. Its use, however, entails keeping the flame in a fixed condition; in other words, it requires that the rate of consumption of gas by the burner shall be fixed and constant. In this case five feet per hour is the rate demanded.

It is for the purpose of securing this uniformity that the apparatus inclosed in the compartment at the right of the table is employed. This cabinet contains a gas meter, pressure gauge and pressure regulator.

On the dial of the meter there will be seen two pointers. One of these revolves in connection with the recording mechanism of the meter proper, but the other is independ-

ent of and is driven by clock-work. Gas passing through the meter at the rate of five cubic feet per hour will revolve the meter hand at a certain rate, and the clock-work is so regulated that its hand revolves at the identical speed. Now, if the correct quantity of gas passes, these two hands will revolve in unison; if not, the gas hand will either fall behind or travel faster than the other, as the case may be. Thus a ready means is afforded of obtaining the correct amount of flow, for by merely turning the gas-cock of the burner it can be regulated until the hands travel in unison. Should any variation occur during the making of a test, it can be allowed for. The burner is provided with a cock, which can be opened and closed by turning a milled nut upon a screw-threaded shaft, as shown in the cut.

The pressure regulator is provided for the purpose of delivering the gas to the meter at a uniform pressure independent of the pressure existing in the outside mains—an essential element where steady and accurate working is sought. Finally, the pressure-gauge, as its name indicates, gives the pressure of the gas fed to the burner, and according to which the regulator is set.

With this much by way of explanation of the method employed in securing a uniform standard, we come to the incandescent lamp itself, the illuminating power of which is to be measured.

In order to arrive at the true value of the incandescent lamp a large number of observations are required, the average of which will give the mean spherical intensity. It is apparent that the lamps as now constructed give out varying quantities of light, according to the positions which they occupy with respect to the object illuminated. Thus, if the lamp be placed upright and observed so that both limbs of the filament are seen, a certain candle-power will be the result. If the lamp be placed so that the edges alone are visible, the result will be different. Again, if looked at from the top or from the side of the holder, the results will vary in each instance, and for each intermediate position between these the illumination varies. If we conceive the lamp to be placed in the centre of a sphere, it will be apparent that under such conditions the interior surface of the sphere will be unequally illuminated. By measuring the intensities of the various parts we can obtain an average, which will be the *mean spherical intensity* of illumination. In other words, we obtain the average illuminating power of the lamp in all directions.

In actual practice this is obtained by measuring the lamp in a large number of positions and in taking the mean of these. Our illustration shows the method adopted for this purpose. The lamp is fitted to a universal joint and mounted on a plate, the periphery of which is graduated to degrees. This in its turn is pivoted to the upright shown at the end of the horizontal bar, so that the lamp can be revolved in the vertical plane. A graduated arc, fixed to the upright, indicates the angle of revolution. The horizontal bar rests upon a supporting table, and can be slid to and fixed at any point. The supporting table is graduated, as will be seen, and can be raised and lowered so as to bring the lamp in the correct position for observation.

This arrangement permits the lamp to be placed in every conceivable position, each one of which is indicated on the graduated arcs. It would, of course, consume too much time, and the result would not be appreciably bettered, to measure the lamp at exceedingly small changes of position, so that in actual practice the difference between successive positions varies from 3° to 45°, according to the

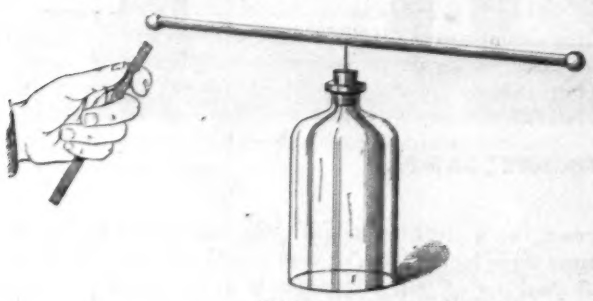


FIG. 1.

nature of the position. Readings are taken with the lamps in the vertical and horizontal positions, and also inclined as shown in the engraving. It is obviously essential to have the lamp always at the same distance from the oil-paper diaphragm, and to insure this two plumb lines are provided, which permit the lamp to be kept at a constant distance.

Although distinct in themselves, the electrical measurements are so intimately connected with the photometrical, that this description would be incomplete without mention being made of them. The photometer table, as will be seen, is provided with plugs and switches for changing the current in the lamps by introducing resistances. Toward the left is a push button by which the operator signals the person in charge of the electrical tests, which are made simultaneously.

The current employed is for obvious reasons best obtained from secondary batteries, and is sent through a galvanometer constantly in circuit. At each new position the current in the lamp and potential at its terminals are noted, so that the final result gives not only the mean spherical and horizontal candle-power, but also the number of watts consumed per candle-power.

Static Electricity.

BY PHILIP ATKINSON, A. M., PH. D.

CHAPTER I.

ATTRACTION AND REPULSION—CONDUCTORS AND NON-CONDUCTORS—QUANTITY AND INTENSITY—STATIC ELECTRICITY DEFINED.

ATTRACTION AND REPULSION.—Amber, called in Greek *ηλεκτρον*, was known to the ancients to acquire, when rubbed, the power of attracting light bodies; hence this property, now known to belong to all substances, has received the name of electricity.

The earliest conception of electricity then was that of a certain kind of force, and the latest discoveries sustain this view.

Electricity may be generated by various simple methods, as follows:

Let a spoon be balanced on the edge of a cup, and an ebonite (hard rubber) knife-handle rubbed on a woolen or silk fabric be held near it, and the spoon will be attracted.

Substitute for the knife-handle a stick of sealing-wax, a lamp-chimney, or a paraffin wax-candle, rubbed in the same way, and the spoon will be attracted by each of them.

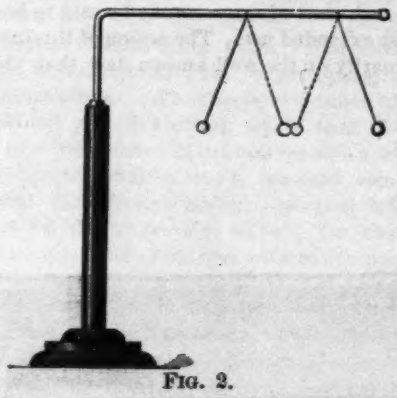


FIG. 2.

These different substances may be multiplied, and different rubbers used, but it will be found that the attractive force, though variable in intensity, is common to all.

The *balanced rod*, represented in Fig. 1, will be found more convenient for these experiments than the balanced spoon. It consists of a round wooden rod, about 20 inches long and half an inch in diameter, with the ends rounded or terminating in balls. It is pivoted at the centre on a point, and may be mounted on a stand, or even on a bottle with a pin through the cork, and made to revolve rapidly by the force of attraction, following any of the electrified bodies already mentioned when held near it, as represented.

A more sensitive instrument for investigations of this class is represented in Fig. 2, and known as the *pith ball electroscope;* the name electroscope being derived from the Greek *σκοπεω*, to see, *ηλεκτρον*, electricity. It is constructed as follows: A small brass rod, bent at right angles so as to have vertical and horizontal arms, has its vertical arm inserted in an ebonite stem attached to a wooden base, giving the instrument a vertical height of about 11½ inches.

The horizontal arm is about 8 inches long, and terminates in a small brass ball. From this arm two pith balls, each about half an inch in diameter, are suspended by white silk threads.

Let the pith balls be separated at the points of suspension, so that when they hang vertically a considerable space shall intervene between them, and let a stick of sealing-wax, previously electrified by friction, be brought near one of them; the ball will be attracted to the wax, and, after a momentary contact, repelled. Follow it with the wax, and it continues to recede as if pushed back by some invisible barrier.

Now let the other pith ball be moved near this one, and they will be attracted to each other, and, after contact, repelled; the lines of suspension showing divergence in each direction as represented.

Let the electrified wax be again brought near, and each ball is repelled by it, so that when it is placed between them, they are driven further apart; but let any non-electrified body be brought near and they are attracted to it.

If each of the balls be separately electrified by the wax, and they are then brought near each other, they will show mutual repulsion without previous attraction.

From this series of phenomena we learn first that electrified bodies not only attract non-electrified bodies, as already shown, but communicate electricity to them by contact; and, secondly, that bodies electrified, either by each other or from the same source, show mutual repulsion.

The first fact was shown when the pith ball, after contact with the wax, attracted the other pith ball; and the second fact by the repulsion of the pith ball from the wax after contact; then of the two pith balls from each other and from the wax, after contact, and finally by the mutual repulsion of the balls, without previous attraction, after being separately electrified by the wax.

This series of phenomena may be produced by using a glass or ebonite rod, or any of the substances already mentioned, as well as by the sealing wax, showing that repulsion as well as attraction is a property common to all electrified bodies.

CONDUCTORS AND NON-CONDUCTORS.—Pursuing our investigation, new properties are developed. It is found that while certain substances, as glass, ebonite and sealing-wax, show electric qualities; others, as brass, iron and copper, apparently do not show such qualities. This leads to the old division of all substances into *electrics*, a term applied to the former, and *non-electrics*, applied to the latter.

But more thorough investigation has proved that electricity may be generated by friction on the brass, iron and copper, as well as on the glass, ebonite and sealing-wax; but that, when generated on bodies of the former class, it is instantly distributed over the entire body, and escapes to the earth unnoticed, if the body be held in the hand, while, when generated on bodies of the latter class, it is not so distributed, and does not pass off in this way; bodies of the former class allowing free electric movement, over the surface or through the mass, while those of the latter class resist such movement.

To make this evident, let a short brass rod, of about quarter inch diameter, terminating in a ball, be fitted to an ebonite handle, as represented by Fig. 3. Let the brass be rubbed briskly on woolen, silk or india rubber, holding the instrument by the handle, and it will attract and repel the pith balls in the same way as the other electrified substances already used. Copper, iron, or any other metal may be substituted for the brass with the same result.

Repeat the experiment, allowing the metal to touch the hand, and the electric qualities disappear. This shows that in the first experiment the electricity was retained, because it could not pass through the ebonite handle; while, in the second, it passed off through the hand.

The results obtained by experiments of this kind led to the abandonment of the doctrine of electrics and non-electrics, and the classification of all bodies as *conductors* or *non-conductors*.

Experiment proves that all substances conduct electricity, and that they all offer a certain amount of resistance to its passage. But it is found that the relative proportions of conductivity and resistance vary greatly in different substances. In some the conductivity is largely in excess, and they are called *conductors;* in others the resistance is largely in excess, and they are called *non-conductors*. Between these extremes there are all degrees of variation; so that in some substances the two properties are almost equal balanced. Hence, since no exact rules can be given, we distinguish the two classes by saying that *a* CONDUCTOR *is any substance of such low resistance that it can be used practically for the transfer of electricity; and a* NON-CONDUCTOR *is any substance of such high resistance that it can be used practically to prevent such transfer.*

LIST OF CONDUCTORS AND NON-CONDUCTORS.—The principal conductors are the metals; silver and copper being the best. Among the partial conductors are the different varieties of carbon, including coal, charcoal and graphite; the acids, saline solutions, water, vegetables and animals.

The principal non-conductors are caoutchouc, gutta percha, sulphur, and their compounds, known as hard rubber, vulcanite or ebonite, dry air, paraffin, shellac, amber, resins, glass when free from metallic substances, mica, silk, fur, wool, hair, feathers, bisulphide of carbon, petroleum and oil of turpentine.

Among the partial non-conductors are porcelain, baked wood, dry paper and leather.

INSULATOR DEFINED.—When a non-conductor is used in connection with a conductor to confine electricity within certain limits, it is called an *insulator;* and the conductor

FIG. 3.

on which the electricity is confined is said to be *insulated*, as a metal placed on a glass or ebonite support, a copper wire wrapped with silk or wool.

QUANTITY AND INTENSITY.—Electric quantity and intensity are similar to the quantity and intensity found in other more familiar forms of energy.

The intensity of any form of energy, other things being equal, is inversely proportional to the mass of the body in which it is developed. A few strokes of a hammer on a small piece of iron placed on an anvil will raise its temperature to a burning heat; while the same number of strokes on a large mass of iron will produce but very slight change of temperature. The *quantity* of muscular energy expended is the same in each case, but the *intensity* of heat energy produced varies inversely as the mass.

Intensity varies also as resistance. A small piece of wood held in the flame of a lamp is quickly ignited at the end in the flame; while the end held in the hand shows no perceptible change of temperature. But a brass rod of the same size, similarly held for the same length of time, becomes too hot for the hand long before the end in the flame is hot enough to ignite wood.

In the wood, the intensity rises rapidly at the end held in the flame, because the resistance prevents distribution of heat through the mass. But the low resistance of the brass permits the rapid distribution of the same quantity of heat through its mass; so that the intensity at the end in the flame is much less than that of the wood.

In kindling a fire of anthracite coal, when the proportion of coal is too great for the kindling-wood, the heat generated by the consumption of the wood fails to ignite the coal, because such coal being a comparatively good conductor of heat, the amount is rapidly distributed through the mass, and hence the intensity at any point is insufficient to produce ignition.

But if the proportion of coal be sufficiently reduced, the consumption of the same amount of wood will produce ignition. The quantity of heat imparted to the coal is the same in each case, but its intensity is greater in the latter case.

In electric experiments there is a great difference noticeable in the amount of work required to produce the same electric intensity on different bodies. Sealing-wax and ebonite, for instance, are quickly electrified, while brass is electrified slowly.

The reason is analogous to that in the illustrations just given: the brass being a good electric conductor, the electricity is instantly distributed equally over every part of its surface, and hence the quantity at any point being small, the intensity is low. But the sealing-wax and ebonite being good non-conductors, the same quantity of electricity is concentrated on those parts of the surface brought into immediate contact with the rubber, instead of being equally distributed over the entire surface; and hence the intensity at those points is proportionately increased.

It will be shown hereafter that in static electricity the electrification is on the surface: hence, in this case, *electric intensity means quantity in proportion to surface*, whether it be the entire surface, as on a conductor, or only those parts to which the electrification is confined, as on a non-conductor.

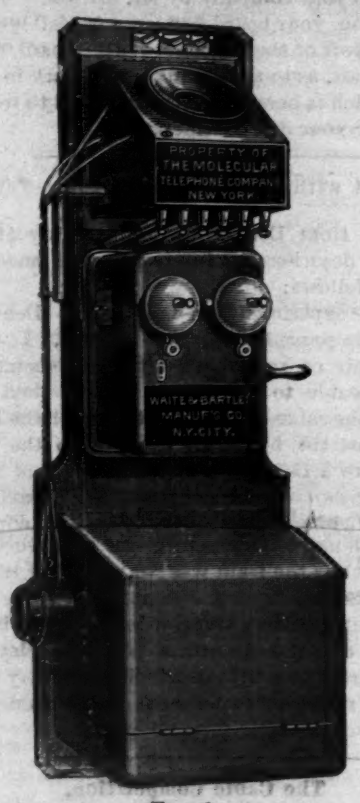


FIG. 1.

It must also be understood, as will be shown more fully hereafter, that the term intensity is as applicable to a diminution of electric energy at a given point as to an increase; in the same sense as we speak of intense cold, as well as of intense heat.

STATIC ELECTRICITY DEFINED.—The terms used to distinguish different classes of electric phenomena, as *frictional*, *static*, *galvanic*, *chemical*, *magneto*, *thermo*, take their origin from the different methods by which electricity is generated, and the various conditions under which its phenomena have been observed, and should not be understood as referring to any difference in the nature of the electricity produced.

The term *frictional* has been used to designate that class of phenomena now under consideration, since friction is one of the principal agencies by which the electricity is generated. But it seems more appropriate to use a term embracing, not merely one agency by which the electricity is generated, but also the various phenomena produced, and distinguishing these phenomena from those pertaining to electricity generated by other methods. And since these phenomena refer chiefly to electricity when stationary, the term *static*, from the Greek στω, to stand, has been adopted, to distinguish electricity observed under these conditions from electricity observed chiefly in a state of motion.

(TO BE CONTINUED.)

The "Molecular" Telephone.

From the time that the telephone became of commercial importance, inventors have sought to construct improved apparatus which should be distinct in character from the inventions and devices that had come before. Messrs. Henry E. Waite and Samuel H. Bartlett have worked in this direction for a number of years, and their labors have resulted in what is known as the "Molecular" or "Cork" telephone. In order, also, to avoid the use of certain devices in existing telephone instruments, they have introduced other methods which accomplish the same objects. The recent and pending infringement litigation of the American Bell Company against the Molecular Company has directed attention to their efforts, and in response to numerous inquiries we now attempt to show what are the peculiar and essential features of the "Molecular" telephonic apparatus.

In the accompanying illustrations, Fig. 1 represents the

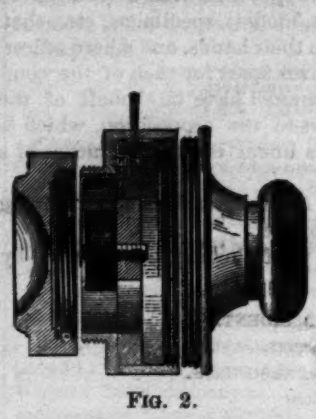


FIG. 2.

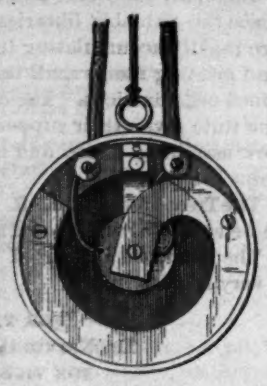


FIG. 3.

office telephone instrument. In this the transmitter is placed above the call-bell, and the battery-box, as usual, below. It will be noted that the hand-telephone hangs loosely on the cord, which passes through two loops on a vertical bar. When the telephone is carried to the ear, the bar is carried with it to a horizontal position, and revolves the shaft connected to it, which passes into the transmitter-box. By this means the bell is cut out of the circuit, and the receiver put to the line.

The receiver represented in Figs. 2 and 3 is of unusual and interesting construction. It will be seen to consist of a magnet bent into a semi-circular shape, with a re-entering end to which is secured a soft iron core. To the side of the case there is secured an iron spring which bears upon the diaphragm and can be regulated by the screw shown. The diaphragm is made of wood, cork, cardboard or other non-magnetic material. Thus the varying currents over the line cause vibration in the spring, which vibration is in turn communicated to the diaphragm.

Fig. 4 shows a modification of this principle, the spring in this type being directly polarized by having one end bent around in contact with the end of the magnet.

The transmitter employed by Messrs. Waite and Bartlett is a modification of the Hughes microphone. Mounted on a sheet of cork are six rods of carbon with reduced ends, the inner one of which fits loosely into holes in a central carbon button. Their outer ends are also supported by smaller buttons, and, as shown in Fig. 5, they are connected up in two series of three in parallel. In the latest form of transmitter used by them the buttons are clasped by brass springs which encircle them, permitting of easy adjustment, and removable in case of breakage or repair.

The articulation of this telephone is very distinct, and inductive effects are considerably reduced in intensity.

An Electrical Underground Railroad for Broadway.

Concerning the prospects of the new charter that passed both branches of the Legislature during the week and is now awaiting Gov. Hill's signature, Melville C. Smith, president of the New York Arcade Railway Company, said on Saturday last: "We have just made a contract for building the road throughout, in which the parties are bound to complete it to Forty-second street within four years. To expertness in the special work which we have

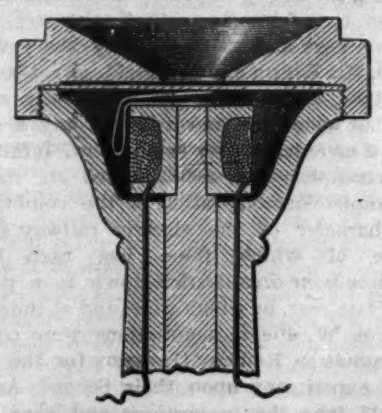


FIG. 4.

to do they add the possession of large means, and the road under Broadway may now be considered secured."

To the question how contracts could be signed to build the road before the bill was approved by the Governor, Mr. Smith said: "If Gov. Hill approves our bill, the road will be built according to its provisions; if he disapproves it, we shall go ahead under the old charter and build a smaller road under the provisions of that. The old charter, which has been some years in existence, authorizes us to construct a four-track road under Broadway from the Battery to Madison Square, and, forking there, to proceed to the Harlem River under Madison avenue on the east and under Broadway on the west. But so little room is accorded to us that we should be compelled, in building a four-track road, which is imperative, to adopt the narrow gauge, which we think is inferior in many respects. The new charter permits us to lay four tracks side by side, of broad gauge, uniform with the other roads coming in from the north, so that on the two other tracks passenger cars could come into the city and proceed as far down as the City Hall Park, stopping and discharging passengers each mile. All the space between the curb-stones is assigned to us in this new bill, but we are prohibited from disturbing the vaults or any of the space under the present sidewalks.

"The two outer tracks will be for accommodation trains and the two inner for express trains, running from the Battery to Harlem River in 20 minutes. Under the new bill, moreover, almost every section is for our restraint, *including a provision that steam shall not be used as a motive power*. The work of construction is to be done under the direction of a Board of Engineer-Commissioners appointed by the Mayor, consisting of Sylvanus H. Sweet, ex-State Engineer; Egbert L. Viele, Park Commissioner and Congressman, and C. H. Haswell, Military Engineer, acting in co-operation with the Department of Public Works. We are bound, in building our road, not to interrupt travel on Broadway, not to interfere with the action of the sewers and gas and water-mains while we are stowing them and the telegraph wires in a commodious vault under our tracks, and to restore the surface of the street as now."

The capital stock of the company is $20,000,000, and the bill provides that the company shall not be allowed to break ground till enough of this has been subscribed, in the opinion of the Engineer-Commissioners, to finish the first section of the road (from the Battery to Forty-second

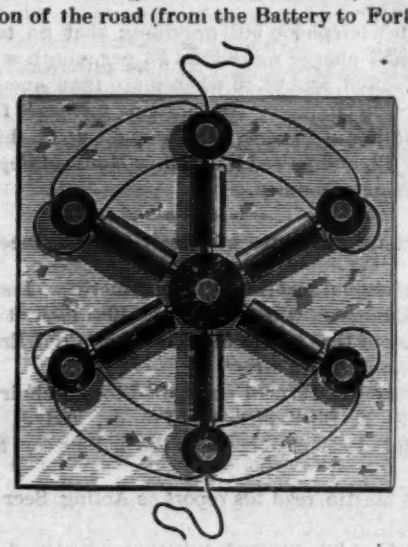


FIG 5.

street). The inner (express) trains are to stop once a mile, entrance and exit to be obtained by dropping the outer or way trains five or six feet at those points, so that passengers can pass over them. It is understood that the Knight-Bentley system is to be used on this road. An illustrated description of the road was given in THE ELECTRICAL WORLD for Aug. 16, 1884. An admirable paper on the subject, by Col. Rowland R. Hazard, appeared in the volume of Transactions of the American Institute of Electrical Engineers published last March.

Another "Fundamental" Patent.

The widespread interest manifested in the electric lighting patent suits fully detailed in our last issue will be increased by the announcement of the issuance of an important patent on the 12th of this month to Sawyer & Man, No. 317,676.

The claims embraced in this patent present special interest in the light of recent developments, and are the following:

1. An incandescing conductor for an electric lamp, of carbonized fibrous or textile material and of an arch or horseshoe shape.

2. The combination, substantially as hereinbefore set forth, of an electric circuit and an incandescing conductor of carbonized fibrous material, included in and forming part of said circuit, and a transparent hermetically-sealed chamber in which the conductor is inclosed.

3. The incandescing conductor for an electric lamp, formed of carbonized paper.

4. An incandescing electric lamp consisting of the following elements in combination: First, an illuminating chamber made wholly of glass hermetically sealed, and out of which all carbon consuming gas has been exhausted or driven. Second, an electric circuit conductor passing through the glass wall of said chamber and hermetically sealed therein, as described. Third, an illuminating conductor in said circuit, and forming part thereof within said chamber, consisting of carbon made from a fibrous or textile material, having the form of an arch or loop, substantially as described.

In order to understand the cause of its issuance at this late day, it must be explained that Mr. Edison filed his original patent on high resistance carbons on Nov. 4, 1879. His patent was issued on the 27th of January, 1880. But in the meantime Sawyer & Man had filed their application on Jan. 9, 1880, and when it came to be acted upon

an interference with the Edison patent was naturally declared. Messrs. Sawyer & Man claimed priority of invention, and the case was carried from the Examiner-in-chief to the Commissioner of Patents, and finally to the Secretary of the Interior. A large amount of testimony was taken on both sides, and the case argued by Messrs. Roscoe Conkling, H. H. Dyer and C. L. Tomlinson for Edison, and by Messrs. Amos Broadnax and H. K. Garden for Sawyer & Man. This patent-office litigation was decided in favor of the latter, and hence the allowance of the patent after more than five years.

We understand that the Consolidated Electric Light Company, the owners of the Sawyer-Man patents, intend to assert their rights, so that more troublous times seem to await the incandescent light.

The Telephone in New England and Illinois.

The following dispatches give the latest intelligence of the action of the Massachusetts Legislative committee on the Bell Company petition; and of the Illinois Legislature:

A unanimous report was made by the Legislative Committee on Mercantile Affairs, May 19, upon the petition of the Bell Telephone Company for leave to increase its stock, giving the company leave to withdraw its petition. The report says the success of long-distance telephoning has not yet been demonstrated, and it was shown that the work of building lines would be undertaken only as the business from time to time should prove to be a commercial success. It suggests that before leave is granted the company should practically demonstrate the possibility of success by establishing lines for actual business between two or more principal cities.

Mr. White's telephone bill providing that no telephone company shall charge more than $3 per month when one telephone is used, and $2.50 when more than one is used, and fixing the charge of transmitting messages from one town to another at 10 cents, was brought up on third reading on May 19, and passed the Illinois House of Representatives almost unanimously.

American Institute of Electrical Engineers.

The first annual meeting of the American Institute of Electrical Engineers was held on the 19th inst. at 8 P. M., at the house of the American Society of Civil Engineers, 127 East Twenty-third street.

Col. Rowland R. Hazard was called to the chair.

Messrs. S. F. Shelbourne, F. Jannus, and J. Wetzler were appointed tellers to canvass the ballots for the election of officers.

Mr. T. C. Martin read his report as Acting Secretary, as follows:

It is provided by our sixth rule that a report of the proceedings of the Institute shall be furnished at the annual meeting. As acting secretary, I am glad, therefore, in fulfilling the requirements of the rule, to lay before the members and associates at our first annual meeting statistics of the most encouraging character.

Under the circumstances familiar to most of the members present, this society came into existence just a year ago. It has already 279 members and associates in all parts of the country. From the numerous inquiries addressed to the secretary and council as to the objects of the Institute, the steady increase in the number of applications for admission, and the work done during the past twelve months, it is evident that the Institute will soon compare in strength and usefulness with the older engineering societies upon which it has been modeled.

As will appear more fully from the treasurer's report, the sum of $2,315 has been raised during the year and the sum of $1,454 expended, leaving a balance of $861.

Soon after the formation of the society the directors of the International Electrical Exhibition, held at Philadelphia under the auspices of the Franklin Institute, tendered to it the free use of rooms in the Exhibition building as long as it remained open. The offer was accepted by the council, and the secretary was authorized to make the necessary preparations and to be present during the exhibition as the representative of the Institute. The rooms were accordingly prepared and were opened to members on Sept. 2, remaining open until Oct. 11. They were visited by a great many members and by several foreign electricians. On Oct. 7 and 8 a meeting was held, partly at the Continental Hotel and partly at the Exhibition rooms, when papers were read and discussed. On the invitation of the Franklin Institute the Exhibition was also inspected by the members in a body.

The first volume of the Transactions of the Institute was published in March of this year. It contains a historical preface detailing the steps taken to organize the Institute, the rules and regulations, and the eleven papers read at the Philadelphia meeting. As the Institute is still so young, it may not be out of place to note that the volume has been given a most cordial welcome at home and abroad, and has been the subject of several complimentary reviews in the scientific press. Of the one thousand copies printed about three hundred have been distributed.

The Institute is without a permanent home, but has not been under the necessity up to the present time of paying rent for offices. All the meetings in New York of the council and the Institute have been held at the house of the American Society of Civil Engineers, through whose secretary, Mr. John Bogart, every possible facility and courtesy has been extended. Several of the scientific and engineering societies of this country, Canada and Europe are desirous of exchanging publications with the institute; but so far no place has been provided the secretary for the accommodation of a library or for the storage of the printed transactions, copies of the rules and other property.

It has, however, been suggested that the scientific and artistic societies of this city shall combine to secure a permanent, handsome and fireproof structure wherein to place the valuable libraries, models, specimens, etc., that are rapidly accumulating in their hands, and where offices and meeting rooms shall be set apart for each of the combined organizations. The council have on behalf of the Institute given their support to the proposition, which is now assuming shape and is under the consideration of a joint committee.

The Treasurer, Col. R. R. Hazard, read his report giving in detail the figures quoted above.

The tellers then reported the following ticket elected by a very large majority.

FOR PRESIDENT.
Dr. Norvin Green.
FOR VICE-PRESIDENTS.
Mr. D. H. Bates.
Prof. A. E. Dolbear.
Mr. Francis. W. Jones.
FOR MANAGERS.
Mr. Charles L. Buckingham.
Mr. David Brooks.
Mr. T. C. Martin.
Mr. Geo. M. Phelps, Jr.
Prof. B. F. Thomas.
Mr. W. D. Sargent.
FOR TREASURER.
Col. Rowland R. Hazard.
FOR SECRETARY.
Mr. Ralph W. Pope.

Votes of thanks were passed to the American Society of Civil Engineers and its Secretary, Mr. Bogart, for courtesies and privileges extended; to Dr. Green for his interest in the Institute and services as President during 1884-5, and to Mr. T. C. Martin for his services as Acting Secretary.

A committee of Dr. Green, Messrs. F. L. Pope, G. A. Hamilton, R. W. Pope and T. C. Martin was appointed to revise the rules and to report as soon as possible.

A little other business was attended to, and the meeting adjourned.

On Wednesday, 20th inst., the Institute met at 10 A. M. During the day the following papers were read and discussed: "The Protection of Electrical Inventions," by Mr. Frankland Jannus, Washington, D. C.; "The Cost of Mine Lighting," by Mr. F. P. Mills, Stambaugh, Mich.; "The Storage Battery in Commercial Use," by Mr. E. P. Roberts, M. E., of Cheyenne, Wyo.; "The Arc Lamp Frictional Clutch," by Mr. E. P. Thompson, M. E., New York, and "The Delany Fac-Simile Telegraphy," by Prof. G. J. Houston, of Philadelphia. A collation was served between the morning and afternoon sessions, and the day was spent most agreeably and profitably. The meeting adjourned about 5.30 P. M.

Electric Railways.

Subjoined we give the first annual report of the trustees of the Electric Railway Company of the United States, presented at the May meeting:

It affords much pleasure to your board to be able to report considerable progress in the work of practically demonstrating the utility of your patents. Some work in this direction, but of less important character, has been done at Menlo Park and at Chicago by the inventors of your system, Mr. Edison and Mr. Field, as far back as the summer of 1883, which work was in its way considered successful, but which was nevertheless only a slight advance upon a mere laboratory experiment. It failed, therefore, to accomplish the result aimed at, namely, to afford a complete demonstration of the commercial and practical character of the electric railway system, in consequence of which there has been but little activity within your organization down to a period near the close of last year, at which time, and at the suggestion of Mr. Cyrus W. Field, negotiations were commenced with the Manhattan Railway Company for the inauguration of an experiment upon their Second Avenue line which should take the proportions and character of a bona fide attempt to substitute electricity for steam upon the lines of that company. A contract was finally made between the two companies under which we are accorded the privilege of the use of the structure, and are granted certain other privileges for the purpose of operating a train or trains of cars as a component part of the active rolling stock of that line operated between the Battery and the Harlem River. Steps were immediately taken to provide the requisite funds for carrying out the work in a proper manner, and the work itself has now been under way for some eight weeks. The published explanations and description of the plans and methods to be employed have been so full and frequent that your board does not consider it worth while to encumber this report with the repetition. Suffice it to say, that as the work progresses the confidence of your board in the practical outcome of the experiment increases, and they do not hesitate to say that if in the main the methods that are being employed do not prove, beyond peradventure, the commercial utility and advantage of railways operated by electricity over those operated by steam, your board will be very greatly disappointed.

The requisite power and electrical apparatus for generating the current have been secured, the conductors for transmitting the current have been purchased and are now being located, the requisite rolling stock has been secured and is now being fitted with the electric motors, and all the work is in such a shape of forwardness that it is possible to predict with some degree of certainty the time when the demonstration shall be made. Your board feel confident that either this month or the next will witness the complete fruition of all their plans, and that the demonstration will be the real starting-point of the great work of substituting electricity for steam.

During the past year some important decisions have been reached by the Patent Office in favor of Mr. Stephen D. Field, which, in the event of their being ultimately sustained by the courts, give to your company the absolute control of railway propulsion by electricity. But aside from this important fact, the numerous other patents owned by your company place it in a very strong position, particularly if the expectations of your board are realized by the experiments now in progress in respect of that patent under which the work is being done, and which was contributed to your company by Mr. Edison.

In conclusion, your board beg leave to call your attention to the report of the president to this board, under date of March 28 last, as to the details of the work in progress, a copy of which is herewith submitted, and to respectfully submit all for your due consideration.

Experiment with the Beecher Portable Telephone.

In a letter from Denver, Col, dated May 11, Captain Lina Beecher describes an interesting and successful experiment, as follows:

I made an experiment to-day on the Denver Circle Railroad that proved a grand success. I took my reel and a pair of receivers on to the locomotive and fastened the cable to the signal bell. I then took the other end of the cable and passed it through the loops that usually support the bell cord back in to the passenger coaches, where I fastened the second pair of receivers, thereby using the cable in the twofold capacity of bell cord, call bell and electric conductor. A conversation was carried on and orders were given and received without a break, while the train was running at a tremendous speed. This proved beyond a doubt that these receivers are preferable to battery transmitters on moving trains. It also proves that the American portable telephone has found an entirely new field in which to display its usefulness. I shall make an experiment in the mines in a few days.

The Cable Competition.

A *Herald* special from London, dated May 13, says: "The annual meeting of the Submarine Cables Trust has just been held, with Mr. John Pender in the chair. He made a lugubrious statement, presenting the report of the trustees as to the old Atlantic cables. Among other things he said: 'The Atlantic cable competition is a very serious matter at present. The tariff is not one that can be regarded as remunerative. The last dividend received from the Anglo-American Company a few days ago was only £490, as against £1,544 in the corresponding quarter of 1884. This competition at the present moment is not likely to lead to higher dividends. The chances are, I am sorry to say, that for a time it is likely to lead to lower dividends. The new company just established must be incurring a very serious loss from the transfer of their investments in other good paying American securities into this system. So far as I can see, if they keep their accounts in the way that they should keep them they cannot show over 2½ per cent. Well, they compete with the Anglo-American cables, and, having all the advantages of modern science, are in a satisfactory position as far as regards competition. On the other hand, our Anglo-American cables have a certain goodwill in the business."

The London *Financial News*, of the 13th inst., commenting on the statement of Mr. Pender, says editorially: "Messrs. Mackay and Bennett will no doubt appreciate the solicitude for their welfare which Mr. John Pender exhibited yesterday at the meeting of the Submarine Cables Trust. Mr. Pender is afraid that they are not making so much money with the Commercial cable as they might make in other investments, and generally he seems to think that he could manage their business for them a great deal better than they manage it for themselves. This is very kind of Mr. Pender, but they have so far shown themselves quite capable of taking care of themselves, and a comparison of their enterprise with those in which Mr. Pender is concerned will show that they do not stand in need of Mr. Pender's assistance. As to the Commercial Cable Company, it differs from Mr. Pender's companies in this: 'It was built by private enterprise with private means; its

shares have not been issued to the public and are not subject to stock exchange speculations; its affairs are conducted on economical business principles, and its earnings are not laid under tribute to support an expensive and useless board of ornamental directors.' The Commercial cable is no doubt a thorn in the side of Mr. Pender, but it has proved a veritable boon to the public. To it we owe the reduction of cable rates which Mr. Pender's company has also been forced to adopt. To it we owe a vastly improved transatlantic service, which, while it may detract from the profits of the old cable ring, has been a blessing to the business community. The Commercial Cable Company has done more for English business men than all the other transatlantic cable companies put together. It has cheapened, improved and popularized the service. It has in a measure awakened Mr. Pender's old fossil companies to a sense of their duty to customers, and however much Mr. Pender may disparage it the public cordially supports it and heartily wishes it well."

"Das Telephon."

We referred last week in an editorial item to a telephonic poem printed by the German *Fliegende Blätter*. Some of our readers want it. Here it is:

Viele Wörter gibt es schon
Auf gut Deutsch fuer "Telephon":
Fernhinsprecher, Weithersänger,
Surrschnur, Säusler, Schallempfänger,
Plapperfaden, Wortaustauscher,
Sprechdraht, Klangstrick, Weithinlauscher,
Ohrverläng'rer, Antwortbringer,
Hausspion, Luftwellenklinger,
Weitschwatz, Kilometerzunge,
Stubenhorcher, Meilenlunge,
Sprechwerkzeug, Besuchersparer,
Tonrohr, muendlicher Verfahrer,
Doppelstahlblechzungenreger,
Klangverbreiter, Blitzwortträger,
Sprechpostschalter, Musikleiter,
Schallmaschine und so weiter.

Mexican Central Telegraph and Telephone Company.

Below we give the treasurer's report Mexican Central Telegraph and Telephone Company:

May 13, 1885.

FINANCIAL STATEMENT, MARCH 1, 1884, TO MARCH 1, 1885.

	Mexican money.	American money.
Total receipts in Mexico for year	$14,544.37	$11,635.50
Total expenses in Mexico for year	10,754.90	8,603.92
Balance	$3,789.47	$3,031.58

American money.

By cash from Mexico, July 1, 1884, to May 1, 1885	$3,257.79	
By loan from J. W. Weed and Geo. William Ballou	1,700.00	
To paid Mexican Telephone Company, royalty 1 year 400 telephones		$2,000.00
To paid Mexican Telephone Company old indebtedness account		1,365.93
To paid Delano old bills in full		171.72
To paid Mickle salary as secretary in full		440.00
To paid office rent to May 1, 1885		241.66
To paid H. Hunter, special services (resolution March 7, 1885)		300.00
To paid supplies sent to Mexico		49.50
To paid traveling expenses		209.00
To paid stationery, printing and office expenses		111.52
Balance		68.46
Total	$4,957.79	$4,957.79
Remittance in transit	$240.00	
Due from Mexican Telephone Company account, borrowed goods	1,300.00	
Indebtedness, note to Mexican Telephone Company, due Aug. 5, 1885		$1,568.82
Notes to Messrs. Weed & Ballou, due April 5, 1886		1,700.00
E. and O. E.	$1,540.00	$3,268.82

By contribution agreement of March 11, 1885, the stockholders contributed to the company 7,346 shares of stock to cancel $20,000 notes and interest. To this the treasury added 1,785 shares, making a total of 9,131 shares, which was accepted by the holders of the $20,000 notes and $1,000 accrued interest in full satisfaction of same, being equivalent to $2.30 per share, par being $10 per share.

The company had of its own stock in treasury 2,350 shares. There now remains in treasury 592 shares and there is still due to the treasury for contribution 72 shares.

During the early months of 1884 the expenses in Mexico exceeded $1,000 per month. (They had before that time been $1,200 per month.) By economical management they have been reduced to $693.88 per month, a saving of over $300 per month, equal to $3,600 per year Mexican, or American money	$2,880
Of the $1,533.40 expended in New York, over $1,200 for rent, salary and expense of reorganizing can be saved this year, rent being $100 per year and no salaries to be paid—an annual saving of, say	1,200
Under new contract we may stop paying royalty of $2,000 per year after Dec. 31 next by puchasing telephones in use (400 telephones at $10—$4,000) by issue of $4,000 bonds at 8 per cent., making annual interest $320 and saving	1,680
Estimated saving in yearly expenses	$5,760

Under new contract with parent company, the Mexican Telephone Company, we may purchase telephones for private lines at $10 per set. This private line business should yield a profit equal to all the exchange business.

With the incubus of $20,000 debt removed, an improved contract, the progressive influence of the Diaz government, the richest territory in Mexico on the only railroad connecting with the United States, and with careful and economical management, the company seems at length to be on the high road to dividends, and a consequent fair market value for its stock.

Respectfully submitted.

HAMMOND HUNTER, Treasurer.

The officers elected on May 13, 1885, for one year, are: President, John W. Weed; Vice-President, George William Ballou; Secretary and Treasurer, Hammond Hunter; Directors, Charles O. Morris, William Reed, John W. Weed, George William Ballou, and Hammond Hunter. Office, 38 Pine street, New York. General Manager in Mexico, Señor Comercial Jones. Principal Mexican office, Guanajuato.

THE TELEGRAPH.

Control of the Egyptian Telegraphs.—A dispatch from Cairo says that the Egyptian telegraph system in Upper Egypt has been placed under the control of the English army officials.

Signal Service Drills.—General Hazen has issued an order directing Signal Service employés in Washington to be on duty from 8:30 to 5 P. M. He has also ordered the employés to drill twice a week, one-half of them on Tuesday and one-half of them on Friday.

To Relieve the Western Union Company.—A bill has passed to its third reading in the New York Senate enabling the Western Union company to proceed by legal steps to reduce the judgment for taxes of $250,000, now held by the State against it under the corporation tax law. The fighting over the measure has been warm and the usual charges of corruption have been made freely.

A Petition for Sale.—Proceedings were begun at Baltimore on May 11, in the city circuit court, for the sale of the property of the Bankers & Merchants' Telegraph Company by petition, and for the removal of John V. L. Graham, one of the receivers. The bill asks for the sale, subject to mortgages of $10,300,000, which Mr. Graham claims are not liens on the property. He will not object to the sale if the proceeds are for the benefit of all the creditors. Mr. Stevens, the other receiver, and Francis W. Jones filed the petition for the sale.

New Marine Station.—The Philadelphia Maritime Exchange recently opened at the Delaware Breakwater a reporting and telegraph station. The station will be kept open night and day for the reception and transmission of cablegrams. Vessels passing the station and displaying their International Code or Coston night signals will be reported in the largest cities in the United States. A delivery service from the Breakwater has been established, and letters and telegrams will be put on board the shipping at the earliest moment. During heavy weather the message, if important, will be signaled by the International Code of Signals. Other important improvements for the benefit of shipping and business men will be made.

THE TELEPHONE.

Providence, R. I.—The net earnings of the Providence Telephone Company for the fiscal year were $53,000, an increase of $7,000 from the previous year.

In Sheffield, England.—The business of the Sheffield telephone exchange has grown so rapidly during the last six months that it is proposed to put it into the hands of a stock company. More than 100 subscribers have been attached in that time, and orders are far ahead of construction.

New England Officers.—The directors of the New England Telephone Company met at noon May 16, and completed their organization by the election of an executive committee as follows: Theo. N. Vail, W. H. Forbes, Thomas Sherwin and Charles J. Glidden, the latter in place of W. A. Ingham, resigned: Three of the four gentlemen are officers of the American Bell Company, which company accordingly retains the executive management in its own hands.

An Assignment.—Frederick W. Watkins, president of the Mutual Telephone Company, of N. Y. City, made an assignment, May 7, to Bernard Metzger, without preference. He was the chief owner of the telephone company, which is a capitalization of territory rights for the New York and Pennsylvania on an acoustic telephone, and it is said he furnished most of the $30,000 required to purchase the franchise. He was a member of the firm of F. W. Watkins & Co., manufacturers of cough medicine.

Absence of Mind.—One of the dry-goods stores has lost a customer, one of the handsome clerks has lost his situation, and all through his miserable education at the telephone. The lady in question is deaf and carries a little tube, with the usual mouthpiece, to speak into. The other day she came up to the counter, and as a preliminary to the conversation touching her proposed purchase, she put the tube to her ear and handed the mouthpiece to the clerk. He immediately put his mouth to it and called out "Hello!" and before he recollected himself the customer had flounced out of the establishment.—*San Francisco Chronicle.*

Southern New England Company.—For the year ended April 1, 1885, the earnings of the Southern New England Telephone Company were $258,255.07, the expenses being $184,774.75. The royalty paid the Bell Company for the last six months was $34,128.51. The net earnings were $73,480.32, showing a rate of 7½ per cent. on capital stock. Total construction for the year just ended was $52,568.16. The number of exchanges on April 1, 1884, was 36. The number of subscribers on April 1, 1885, was 5,634, against 5,615 for the corresponding date in 1884. During the year 1,149 instruments have been removed and 1,179 placed with subscribers. On account of the increased cost of carrying on the company's operations, two advances in rentals have been made during the year, and a general increase of prices in all the more considerable exchanges is in contemplation.

The Neumayer Telephone Receiver.—In this receiver the magnet is formed by five small bars of the best quality of English steel. In order to obtain an increase of mobility in the magnetism, the inventor employs a bundle of very fine iron wires in connection with the pole nearest to the membrane. Toward its centre this bundle is soldered to a brass socket, a small part of which makes good contact with the magnetized rods, while the other part supports the coil, which has a resistance of about 100 ohms. To avoid the variations of distance, which are in effect variations of temperature, between the pole and the diaphragm he has a plate of brass soldered to the centre of the bundle of wires, to screw upon the box carrying the vibrating plate; this box is of brass, and the diaphragm, of a thickness of three millimetres, rests upon a breadth of two millimetres upon the upper part of the box. The magnetized bars are maintained in a brass ring, which has a corresponding number of grooves.

THE ELECTRIC LIGHT.

Hamilton, O.—The Hamilton, O., Electric Light Company has been incorporated, and will use the Thomson-Houston system.

In an Electric Light Shade.—A pair of English sparrows have built their nest within the glass shade of one of the electric lights in Bridgeport, Conn.

Greenfield, Mass.—It is proposed to form an incandescent lighting company at Greenfield, Mass., and a preliminary organization has been formed by Mr. P. H. Alexander, representing the Weston lamp.

In Australia.—An installation of the electric light has been successfully effected at the Eveleigh locomotive running sheds in Sydney. There are about 500 lamps in one bay of the shed, the light from each being reckoned to equal a 20-candle gas-burner.

Germantown, Pa.—The Electric Light Company, says the local *Independent*, is receiving applications constantly for additional lights, but will not be able to accommodate all until the increased plant is in operation, when a number more will be added.

A New York Theatre.—The People's Theatre, Bowery, is to be lighted with the Edison system early this fall. Harry Miner, proprietor, has contracted with the Edison Co. for a 400-light plant for this theatre, including an 80 H. P. N. Y. Safety Steam Power Company outfit of steam power.

Maryland.—The United States Electric Light and Power Company has been incorporated in Baltimore, Md., by James P. Clark, Augustus G. Davis, Charles F. Dieterich, George P. Frick, James L. McLane, W. Lorman Roberts and Arthur B. Proal, to manufacture electricity for illuminating purposes, power, etc. Capital stock $500,000. There is talk of a $30,000 electric light company in Salisbury, Md.

The New York World.—Our enterprising contemporary, the New York *World*, has just contracted with the "Edison Company for Isolated Lighting" for a 350-light plant, and with the N. Y. Safety Steam Power Company for a 50 H. P. automatic engine to drive the dynamo. The plant will be a noticeable addition to Park Row, and will make the columns of the *World* brighter than ever, if increased brilliancy be a possibility.

Schuyler Lights.—The Schuyler Company shipped from Hartford to Philadelphia last week an incandescent plant, to be used in lighting several business houses, among which is the large banking house of E. W. Clark & Co. It is stated that the officers of the Allentown and Bethlehem electric light companies, in Pennsylvania, recently made a tour of examination in the different cities using the various systems, and after seeing the Holyoke plant of the Schuyler Company, placed an order with it for an arc plant for Allentown.

Electrical Development in Germany.—During the past six years dynamos to the number of 6,000 have been constructed in the different workshops in Germany, representing a value of $3,500,000. The number of arc lamps made during the same period was 20,000, realizing $1,250,000. In the four years 1880 to 1884, the number of telegraph offices open to the public rose from 5,114 to 7,529, and the mileage of the wires from 121,520 to 150,040 miles. The telephone was introduced into Germany in 1880; there are to-day 58 country exchanges, having 7,811 subscribers, and possessing a network of wires extending over a distance of 10,100 miles.

To Decorate a Bottle.—A firm of brewers at Vauxhall, England, are about to erect an immense weather vane in the shape of a bottle, 20 feet long and 6 feet diameter, on the summit of their premises. It is proposed to light each end of the bottle with a powerful arc light of 2,000 candles—the one showing red, the other white rays, so that the direction of the wind may be ascertained by night as well as by day. Such a mass, though built as lightly as possible, requires some skill to arrange for a free movement on its centre. Therefore it has a stem of about 14 feet, accurately and well fitted inside a tower, the top support being on rollers, while the base rests in a glycerine bath. The function of the latter is to ease the weight, which is 3½ tons, from its roller bearings.

Ottawa, Can.—The Royal Electric Company, of Montreal, has completed the arrangements under its contract for lighting the city of Ottawa with the Thomson-Houston system, and the lamps were first lit on May 1. The *Daily Free Press* of May 2 says: The lighting of the city by the new process will be a boon in many ways. The leading directors and managers of the Royal Electric Light Company and the directors of the Ottawa Electric Light Company and civic representatives inspected the lights in a body. The universal comment was that of gratification, and the Capitalians now feel delighted at this advanced step by the city council of adopting the light, and over the prospect of having the capital thoroughly lighted for three years certainly, and, no doubt, ten years to come.

A New Infernal Machine.—Two German gentlemen arrived in London recently with an invention in the shape of an electric light lamp, which they intended to submit to the Chief of the Metropolitan Fire Brigade. At the Custom House, however, upon the baggage of the gentlemen being searched, the officials thought they had come across an infernal machine, and promptly arrested the gentlemen and appropriated the invention. The unfortunate inventors were detained in custody all one day pending the verification by telegram of their statements, and at a late hour of the night they endeavored to see Captain Shaw, in order to explain their grievances. An appointment was made for the next morning, but the electric lamp had to go untested, for the officials had sent it to Woolwich for the purpose of examination by Colonel Majendie.

In a Paris Workshop.—The workshops of the Librarie Hachette in Paris are completely and effectively lighted by electricity. The installation comprises about 400 incandescent lamps variously distributed, the current being supplied by one dynamo of 200 lamps, and two of 60 lamps each. These are actuated by a motor of 50 horse-power. The principal dynamo, which is placed in a position about 20 metres distant from the others, is driven by a machine of 25 horse-power specially devoted to this installation, and which, in case of accident, can be utilized to drive either or all of the three dynamos. The lighting can be effected either with one dynamo or with the three coupled in multiple arc. The 60-lamp dynamos are by Edison, of the pattern shown in the Electrical Exhibition of 1881, while that of 200 lamps is a new model, giving a current of 150 ampères, with a tension of 120 volts at a speed of 1,300 revolutions. The internal resistance of the coil is 0.023 ohm.

Electric Illuminated Clock Dials.—At the General Post Office, Melbourne, Victoria, the upper portion of the clock tower will be taken down, and it will then be raised till its total height reaches 188 feet; the present illuminated dials, which are too small to be of any practical use, will be dispensed with, and four new skeleton dials, each about 13½ feet diameter, will be provided, the centre of the dials being about 132 feet from the ground. A new feature will be introduced in connection with these dials; they will be made of cast iron, and will have hemispherical recesses so spaced as to mark the hours in place of the usual numerals; these will be nickel-plated inside so as to reflect the sunlight and form bright points in the daytime, and in these cups incandescent electric lights will be placed, while similar lights of smaller size will be arranged in a close row along each of the hands. It is anticipated that this arrangement will make it possible at night to tell the time by this clock at a great distance.

Utilizing Water Power.—The residence of J. Wilson, Esq., Daramona County, Westmeath, Ireland, has recently been lighted by means of the electric light. The motive power is derived from a small waterfall, situated about half a mile distant; the current is conveyed to the house by means of bare leads, supported on poles and insulators. The lighting of the house is effected with incandescent lamps, working off Frankland accumulators. The current is supplied during the day from a dynamo driven by a turbine. At a grand ball given there recently, the ball room was brilliantly lighted with the electric light, when no fittings whatever were employed, the incandescent lamps (20 candle-power) being supported upon the shrubs, trees, and floral decorations of the room. A very pretty effect was introduced by placing some of the lamps in large bowls containing tinted water, and another and refreshing one, by burying looking glasses in moss and ivy, and incorporating with this latter lamps of 10-candle power in such a way that the lamps were not visible, so that the arrangement resembled little crystal ponds.

The Unlucky Exposition.—A dispatch of May 6, from New Orleans, says: At 1.40 o'clock this afternoon a sudden and violent wind-storm, accompanied by a downpour of rain, blew down three tall sheet-iron chimney stacks at the boiler house of the World's Exposition steam department. The chimneys fell across the roof, breaking it down and wrecking the steam and hot water supply pipes. The steam was turned loose by the breaking of the steam pipe from the boilers in full operation, and it escaped into the atmosphere upward through the broken roof with a terrific noise, until the boilers were all empty. Twenty men were working around the boilers at the time, but not one of them was hurt except a fireman, who received a slight cut on the temple. This accident stops all the operating machinery in the main building and all the electric light apparatus. This boiler plant is claimed be the largest in the world, burning 260 fires, and embracing boilers aggregating 5,000 horse-power contained in a boiler-house 300 feet long in the rear Machinery Hall, and is separated from it by a street. Boilers to the amount of 1,500 horse-power are permanently disabled for the balance of the Exposition, but a few days' work will make available 3,500 horse-power, which will work more of the machinery. This accident extinguishes the electric lights, and the Exposition grounds are in darkness to-night for the first time since the opening.

APPLICATIONS OF POWER.

Electric Stitches.—Sewing machines are now being run by electricity in Cleveland, New York, Philadelphia, Boston, Detroit and Baltimore. The little Stockwell motor is used.

Siemens vs. Field.—A dispatch of May 18, from Washington, D. C., says: "The Commissioner of Patents has denied a motion for a rehearing in the patent interference proceedings of Siemens against Edison against Field. The matter at issue was a patent for the application of electricity as a motive power to railway cars by means of the rails, and the decision of the Commissioner sustains the findings of the examiners in awarding priority of invention to S. D. Field of New York.

Steering Gear.—A number of steamship men and inventors assembled in a machine shop in York street, Brooklyn, yesterday, and watched the workings of an automatic steering apparatus constructed for the United States steamer "Despatch." The tiller wheel chains are worked by a cylinder which has communication with a compressed air supply chamber. The workings of the cylinder are governed by electricity, and can be controlled from the pilot house or by the officer on the bridge. There is a telltale mechanical compass attached to the steering gear. This, when set to the course ordered, will ring a vibrating bell placed in the captain's room should the vessel deviate from that course from any cause. The apparatus is noiseless, and the exhaust air can be used for ventilation between decks and in the firerooms of steamers. Two 600-pound weights were attached to ropes running on large pulleys as a substitute for a tiller chain. These were lifted and lowered with ease. The new steering machine will be placed on board the "Despatch" next week.—*New York Times.*

An Electric Railway for Philadelphia.—A special meeting of the Fairmount Park (Philadelphia) Commission was held on Saturday last, the 16th inst., to consider plans for the proposed electric railway. It was discovered that the route of the railway from the junction of Belmont and Elm avenues to the top of George's Hill would cut across many of the roads and walks, but Superintendent Thayer stated that the route could be arranged in such a way that only two of the roads would be crossed. The Committee on Superintendence and Police was instructed to consider the matter, and the superintendent was instructed to stake out the grounds and attend to the other details. The license gives Rosengarden & McDuffee, the builders, the right to use all that portion of the park necessary for the tracks of the railway. They are required to illuminate Belmont avenue from the top of the hill to Belmont Mansion with electric lights during the summer evenings, without expense to the park. They are also required to erect three ornamental stations for the shelter and accommodation of passengers—one at Elm avenue, one at the foot of George's Hill, and the third at the northern terminus of the railway.

MISCELLANEOUS NOTES.

Fire at Menlo Park.—The barn and outbuildings of Thomas A. Edison, at Menlo Park, N. J., were destroyed by fire early on the morning of the 6th inst. The loss was $8,000.

The Universal Law.—Some experiments recently made in France show the accumulation of minute particles of dust, etc., on electric light wires to be the result of electrical attraction.

Electric Baths.—The National Electric Bath Company has been incorporated in Washington, D. C., with W. W. Karshner, Charles M. Nye and Charles D. Hudson as directors. Capital, $100,000.

Wires to Go Underground in Pennsylvania.—In the Pennsylvania Senate, at Harrisburg, on May 15, Mr. Reyburn called up on second reading the bill requiring telegraphic, telephonic and electric-light wires and cables used in all cities of the first and second class to be placed underground as soon as the councils in the cities affected shall direct the time and manner of removal of poles, wires and cables. The companies are given six months in which to remove poles, etc., and if they fail to do so, councils shall remove them. The bill was passed without opposition, after Reyburn had amended the title to correspond with the body of the bill.

STOCK QUOTATIONS.

Telegraph, telephone and electric light quotations on the New York Stock Exchange, Boston Exchange and elsewhere are as follows:

Telegraph.—Am. Cable, b 57½, a 59; Am. Dist. Tel., b 15, a 20; B. & M., a 3; Postal stock, b 1½; Postal sixes, a 12¼; Western Union, b 59¼, a 59½.

Telephone.—Am. Bell, b 196, a 197; Erie, b 21½; Mexican, b 71¼; New England, b 31½, a 31¾; Tropical, 61¼.

Electric Light.—Edison, b 62½.

BUSINESS NOTICES.

Early Telephony.—All persons who experimented with or used the Reis telephone before the year 1876 will please send their address to Briesen & Steele, 229 Broadway, New York.

Anti-Magnetic Shields for Watches.—These shields made by Giles Brothers & Co., State and Washington streets, Chicago, are an efficient protection to the works of watches from magnetism, as many testimonials in their possession show. This firm also demagnetize watches which are already affected.

OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

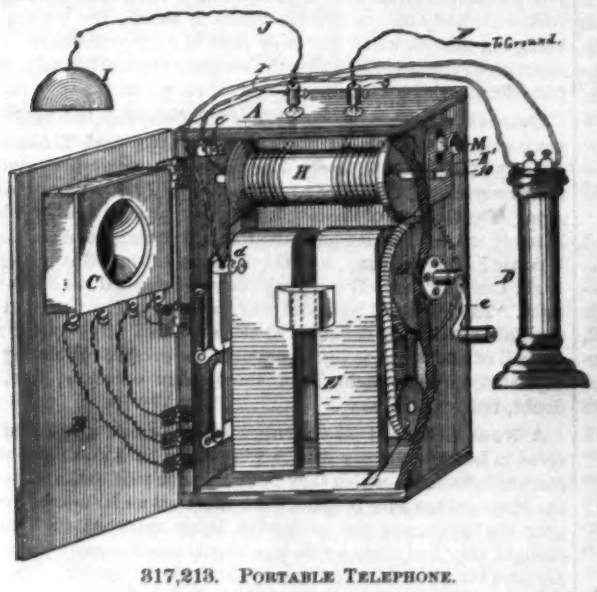
PATENTS DATED MAY 5, 1885.

Telegraphic Relay; George W. Gardanier, New York, N. Y..... 316,956

Consists of two ordinary Morse relays, their armatures closing their respective local circuits on the back contact, and two transmitters, each having a rear spring-contact, and adjacent to the upper side of the forward end of the lever, a fixed contact or one without spring-action.

Apparatus for Carbonizing Incandescents; Otto A. Moses, New York, N. Y..... 316,993

Consists in subjecting the material which is to be carbonized to the action of heat to a sufficient degree to carbonize the same, after it has been placed in a mold of sufficiently refractory material having approximately the form which it is desired to give to the filament, and at the same time, if desirable, immersing the filament in a carbonaceous or hydrocarbonaceous gas which has been superheated while being conducted thereto. The superheated gas is in this case caused to pass through the entire length of the mold, and to deposit more or less of its carbon upon the filament contained therein. The form of the mold is preferably such that



317,213. PORTABLE TELEPHONE.

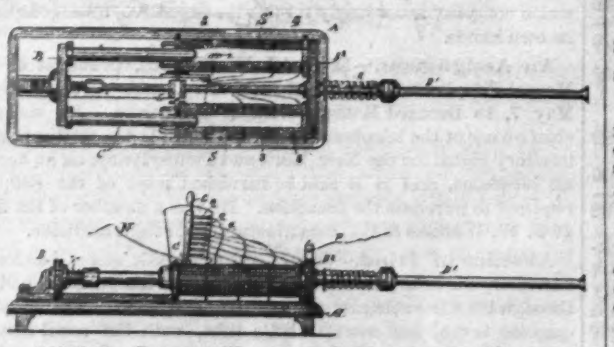
the filament will be held under greater or less tension during the process of carbonizing by reason of the friction which exists between the same and the inner surface of the mold.

Incandescent Electric Lamp; Carl H. F. Muller, Hamburg, Germany..... 317,171

Consists of a carbon filament in the shape of an open double spiral, the windings of which extend in an inclined horizontal direction and cross each other, so that the filament presents an equal amount of lighting-surface on all sides.

Battery Fluid; Isaiah L. Roberts, Brooklyn, N. Y... 317,206

Consists of permanganate of potash and the salt of an alkali dissolved in water, combined with the negative and positive elements of a battery cell.



317,249. ELECTRO-MAGNETIC RECIPROCATING ENGINE.

Portable Telephone; Oliver H. Saxton, Washington, O..... 317,213

The object is to provide a telephone which may be attached anywhere along the main line for the purpose of taking messages. As clearly shown in the cut, it contains a drum *H*, a magneto-signaling device *E*, transmitter *C* and suitable connections and adjuncts.

Electric Railway; Frank J. Sprague, North Adams, Mass., Assignor to the Sprague Electric Railway and Motor Company..... 317,235

He provides main conductors under ground and working conductors above ground, the two being connected at intervals.

1. Process of and Apparatus for the Separation of Gold from its Ores by Electro-Chlorination and Deposition; Edward P. Thompson, New York, N. Y., Assignor of three-fourths to Edward P. Roberts and G. H. Pierce, both of Cheyenne, Wyo. 317,245

2. Process of and Apparatus for Electro Deposition of Gold from its Chlorides; Edward P. Thompson, New York, N. Y., Assignor of three-fourths to Edward P. Roberts and G. H. Pierce, both of Cheyenne, Wyo..... 317,246

1. Chlorine is liberated by electrolytic action in a secondary battery having cathodes which are adapted to be heated to a high temperature by superheated steam; the electrolyte being common salt water slightly acidulated by hydric sulphate.

2. The deposition cells consist of carbon anodes arranged in a circle between two thin and corrugated or fluted copper foil plates, the former being adjustably supported and adapted to be taken apart by the removal of screw bolts.

Electro-Magnetic Reciprocating Engine; Charles J. Van Depoele, Chicago, Ill..... 317,249

The solenoids are each made up of short solenoids, as shown in the cut. The cores are each made of short cores fastened together and of the same length as the small solenoid, although the cores in the cut appear to be of one continuous piece.

Revolving Telephone Stand; E. Forest Weaver, Philadelphia, Assignor of one-half to George H. Perkins, of same place..... 317,252

Consists of improvements upon his patent of June 28, 1881, No. 243,663.

Support for Underground Electric Lines; Solomon J. Fague, Washington, D. C..... 317,326

Consists of an upwardly-converging double-inclined support formed in sections, having longitudinal grooves for receiving the electric conductors, and provided with a suitable covering on the sides and tops.

Telephone Transmitter; George W. Drawbaugh, Eberly's Mill, Pa., Assignor to People's Telephone Co., New York..... 317,445

Two electrodes support a bridge, which is pivoted above the electrodes, the pivot sustaining a portion of the weight. The three contact pieces are so curved as to their surfaces that they have considerable area of contact in comparison to their weight.

Push Button; Thomas C. Frenyear, Boston, Assignor of one-half to Lloyd E. Razee, Attleborough, Mass.... 317,450

The metal or other plate has the holes or openings for the reception of the button-cases *C*, and is provided with means for securing it to the desk or wall. Its surface, in whole or in part, is covered by some suitable substance that renders it distinct at night, as luminous paint.

317,450. PUSH BUTTON.

Insulator for Electric Wires; William H. Wright, Rochester, N. Y..... 317,479

Below the screw-thread in the ordinary glass insulator, there are provided vertical grooves in the neck, for the purpose of providing a neck as usual and a strong support for the same.